

RubberWorld

The technical service magazine for the rubber industry

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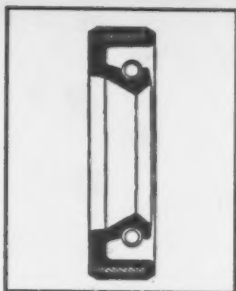


Shear stress in automotive powertrain

Advances in rubber

High carbon black





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Acquisitions, expansions; contracts, licenses; financial statements; markets, news.

8 Tech Service: Design basics: Stress-strain relationships

by Jon Menough, contributing technical service editor. A look at the stress-strain relationships in rubber, including hardness and tension tests, and the roles they play in design applications of rubber.

10 Urethane Forum: Polyurea RIM; novel applications and technical advances

by R.J.G. Dominguez, D.M. Rice and R.A. Grisby, *Texaco Chemical*. The focus of this review is to enable the reader to understand how polyurea RIM materials address the processing and property needs of the RIM industry.

15 Shaft seals: Automotive powertrain applications

by Robert Bond, *CR Industries*. This article reviews existing shaft seals used in the automotive powertrain, the perceived trends in the automotive industry and how the sealing industry is handling the problems of meeting these trends.

24 Adhesion of tire cords - the total picture

by Raj Iyengar, consultant. The author reviews the effects of polymer/fiber, fiber surface, cord/fabric geometry, finish, adhesive, rubber characteristics, and environmental exposure of cords on adhesion, and stresses the importance of considering the total impact of the cord/adhesive/rubber system in solving adhesion problems.

30 Optimum loading of carbon black in rubber by Monsanto oscillating disc rheometer

by Anil K. Sircar, *Center for Basic and Applied Polymer Research, University of Dayton*. Evaluation of different carbon blacks by the measurement of rubber properties is an accepted industrial practice. This article suggests that carbon blacks should be compared at the "optimum loading" which is different for different blacks.

36 Patent News

edited by Bob Samples, *Akron Rubber Development*

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New equipment, instruments, CAD/CAM, products and materials

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Cover

Cover photo courtesy of Products Research & Chemical Corp.

A Lippincott & Peto Publication

Editorial

In these days where everything is computerized, there seems to be a glut of statistical information. The sheer mass of figures that bombards us daily makes it hard to discern just what has relevance. We recently received a study indicating that in the year 2000 each tire worker will produce five times more miles of tire life than in 1980. This came from Technology Futures Inc. of Austin, TX, who recently did some interesting numbers crunching that pertains to the rubber industry. *Implications of improved productivity on future jobs for tire workers* is a different type of study that was conducted to learn how manufacturing innovations (productivity) and product changes (average tire life) affect future requirements for new tires and what these changes mean for future employment in the industry. The forecast is for a gradual decline in total employment for American tire workers by the year 2000, but not due to decreases in the use of domestic made tires. FTI says that the increase in utility of each tire produced coupled with the increases in productivity for each worker will be the main causes.

Although the study is directed at ascertaining employment levels, the other information presented is interesting. Projected average speed for all vehicles in the year 2000 will be 74 mph. Had it not been for the 1973 fuel crisis and the implementation of 55 mph limits, average speed would have been 95 mph based on an average speed increase of 1.4% per year which occurred between 1945 and 1973. FTI's data shows an increase in average tire life of 1.3% per year, representing a long doubling time of 55 years. But when you factor in the increases in average speed, mileage per tire increased at a rate of 4.2% per year between 1930 and 1970. By 2000, mileage per tire at 60 mph is projected to reach nearly 60,000 miles, a doubling time of 17 years. The number of tires produced per worker per year has increased at an average rate near 4.3% per year since 1947, meaning the number of tires produced per tire production worker will double by 2000, the study says. But a more accurate view of productivity combines the average tire miles and tires produced per worker to show tire miles produced per worker, which will be at 310 million miles of tire life in 2000, more than twice the 136 million miles of 1985. Then if you add technology of performance to reflect the effects of increased speed, TFI predicts that nearly 500 million miles of 60 mph tire life will be produced by each tire worker in 2000, five times more than in 1980.

All these numbers are interesting. Whether or not they have any utility is debatable. One number I found of real interest was included in a table entitled *Forecast for jobs*. Through the year 2000 there is forecast a decline in tire worker employment while the numbers of tires per worker per year increases significantly. But the real eye catcher is number of tires produced per year. TFI's numbers reach 397 million, a 155 million increase over 1984's totals! If this total bears out we're in for a great ride whether it be at 55, 60 or 74.

Don R. Smith
Editor

RubberWorld

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OTHER LIPPINCOTT & PETO PUBLICATIONS

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Business Briefs

Iestrom plant near Oslo, Norway for European markets.

Bridgestone Corp. opened a representative office in Beijing, China.

Peabody TecTank, Parsons, KS will fabricate and sell the gravity-flow Phillips In-Tank Blender under license from Phillips Petroleum.

Financial statements

ARCO Chemical reported net income of \$66 million on revenues of \$503 million for the third quarter.

Blasius Industries' operating income for the first quarter of 1988 was \$703,000 on sales of \$11.9 million.

Carlisle Companies' third quarter earnings were \$5.4 million on sales of \$141.8 million.

Cooper Tire & Rubber reported third quarter net income of \$8.2 million on sales of \$176.5 million.

Essex Chemical reported third quarter net income of \$95,000 on sales of \$53.6 million.

BFGoodrich had a net income of \$42.4 million for the third quarter on sales of \$564 million.

Goodyear reported third quarter income of \$170.4 million on sales of \$2.5 billion.

M.A. Hanna reported net income of \$10 million for the third quarter on revenues of \$135.1 million.

NL Industries' third quarter net income was \$18.2 million on net sales of \$355.6 million.

Lydall, Inc. reported third quarter earnings of \$741,000

on sales of \$33 million

Parker Hannifin reported a first quarter net income of \$21.8 million on sales of \$498.5 million.

PPG reported third quarter net earnings of \$91.3 million on sales of \$1.26 billion.

Rubbermaid reported third quarter net earnings of \$24.3 million on sales of \$276 million.

The Standard Products Co. reported first quarter net

RMA rubber report through August (figures expressed in metric tons)

	YTD 1987	YTD 1986	% change
Total new rubber			
New rubber available	2,180,147	2,020,583	7.90
Imports	742,838	693,346	7.14
Exports	330,034	252,228	30.85
Apparent consumption	1,845,131	1,759,886	4.84
Total natural rubber			
Imports	551,684	521,066	5.88
Exports	23,283	25,937	-10.23
Apparent consumption	526,582	504,237	4.43
%total new rubber	28.53	28.65	
Total synthetic rubber			
Production	1,437,309	1,327,237	8.29
Imports	191,154	172,280	10.96
Exports	306,751	226,291	35.56
Apparent consumption	1,318,549	1,255,649	5.01
Total SBR			
Production	559,147	507,762	10.12
Imports	54,455	68,057	-19.99
Exports	111,925	63,405	76.52
Apparent consumption	503,895	515,262	-2.21
Total nitrile			
Production	43,824	40,948	7.02
Imports	10,278	8,107	26.78
Exports	9,044	7,800	15.95
Apparent consumption	43,933	40,979	7.21
Polybutadiene			
Production	240,881	230,244	4.62
Imports	57,743	36,280	59.16
Exports	41,967	14,116	197.30
Apparent consumption	258,652	237,788	8.77
Ethylene-propylene			
Production	167,720	158,120	6.07
Imports	4,014	3,072	30.66
Exports	31,152	31,107	.14
Apparent consumption	135,192	126,129	7.19
Butyl, polychloroprene, polyisoprene, silicone and other synthetic elastomers			
Production	425,736	390,162	9.12
Imports	64,664	56,764	13.92
Exports	112,663	109,863	2.55
Apparent consumption	376,877	335,491	12.34

RMA tire report through July (figures in thousands of units)

Passenger tires	YTD '87	YTD '86	% change
Shipments			
original equipment	31,893	32,602	-2.17
radial	27,022	27,330	-1.13
replacement	84,698	74,438	13.78
radial	75,568	63,819	18.41
export	3,222	2,175	48.14
radial	2,792	1,646	69.62
total	119,813	109,215	9.70
radial	105,382	92,795	13.56
Production			
radial	96,729	91,172	6.10
radial	84,439	77,033	9.61
Truck & bus tires			
Shipments			
original equipment	4,658	4,138	12.57
radial	3,238	2,749	17.79
replacement	19,354	16,161	19.76
radial	10,355	7,619	35.91
export	1,109	762	45.54
radial	779	466	67.17
total	25,121	21,061	19.28
radial	14,372	10,834	32.66
Production			
radial	20,480	17,956	14.06
radial	11,590	8,657	33.88

Business Briefs

U.S. industrial rubber product shipments (millions of dollars)

Item	1977	1986	1991	1995	% Annual growth	
					86/77	91/86
GNP (bil\$)	1991	4206	5850	7675	8.7	6.8
rbr prdts/000\$ GNP	1.58	1.35	1.23	1.11	-	-
Industrial rubber prod. shpts.	3142.6	5683.6	7200	8550	6.8	4.8
belts & belting	609.3	784	920	1035	2.8	3.3
hose	709.2	1076.7	1340	1570	4.7	4.5
molded & other mech. prods.	1824.1	3822.9	4940	5945	8.6	5.3
Price Index (1986=100)	70.3	100	113.4	123.6	4.0	2.5
Ind. rubber products (bil 1986\$)	4470.3	5683.6	6920	6920	2.7	2.2

source: Freedonia

income of \$4.4 million on sales of \$102.7 million.

Markets, news

Industrial rubber products shipments are projected to grow 4.8% per year through 1991 to \$7.2 billion according to an industry study, *Industrial Rubber Products*, from The Freedonia Group, Cleveland, OH. Virtually all rubber sectors will experience slow growth (below GNP) which will result in real shipment growth of about 2.2% per year. Price increases will be low as a result of continued import pressures. Limited opportunities are anticipated in selected niches such as single ply roofing.

Competition from polyurethane and plastics will affect growth in hose and belting markets. Traditional consumers, agriculture and mining, are expected to recover through 1991 as oil prices increase, the study says. Opportunities are expected for molded rubber products in the oil and gas market and off-highway products, as well as appliance, farm and mining products.

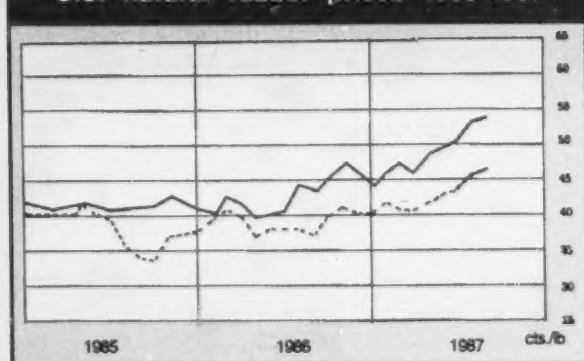
Another study, this one by Eldib Engineering & Research, Berkeley Heights, NJ, predicts that the retail condom market, which is already at \$194 million, will be in-

creasing 13-14% each year, bringing the market to \$275 million in 1990. This 40% increase from 1987-1990 will create a demand for new materials and represents opportunity for suppliers of natural and synthetic latex, as well as for companies who currently have latex dipping operations.

The U.S. International Trade Commission unanimously determined that there was reasonable indication that U.S. producers of nitrile rubber were injured or threatened with injury by reason of imports of nitrile rubber from Japan. The antidumping petition was filed by Uniroyal on behalf of the domestic nitrile industry. The petition states that Nippon Zeon is selling nitrile rubber in the U.S. at a price significantly below its fair market value in Japan. As a result of the ITC determination, the Department of Commerce will now investigate the alleged unfair pricing.

The current tight market for butadiene in Europe and the U.S. may be only temporary according to Chem Systems, Tarrytown, NY who just published *C₄ Olefins in Europe*. A key part of the analysis is a world trade balance, which indicates a growing surplus of butadiene in Europe as imports by the U.S. drop to zero by about the end of the decade and the U.S. develops its own butadiene surplus.

U.S. natural rubber prices 1985-1987



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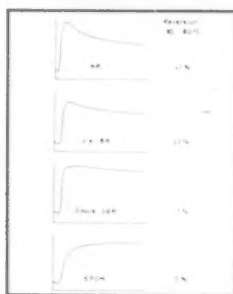


Non-tire automotive:

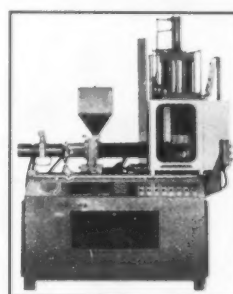
- Materials for hose and tubing
- Belt design and future design objectives



Non-tire automotive p. 14



Microstructure and reversion p. 30



Techno Mart p. 49

6 Business Briefs

Acquisitions, expansions; contracts, licenses; financial statements; markets, news.

8 Tech Service: Design basics: rubber in compression

by Jon Menough, contributing technical service editor. This month's column looks at the interplay of compression, shear and torsion on rubber products, specifically with the effect of simple compression.

10 Urethane Forum: Automotive RIM market to grow 30% by 1990

by M.C. Cornell, Dow Chemical. A look at the reaction injection molding process, including the improvements it has undergone since 1974, and predictions for its future potential, particularly in the automotive market.

14 Automotive belt design and future design objectives

by John Merry, Gates Rubber. The author provides a perspective on the materials and design factors with sources of information and anticipates trends for the future regarding automotive belts.

21 Selection of polymers for automotive hose and tubing applications

by James W. Horvath, Goodyear Tire & Rubber. The author provides guidance on the usual polymers, characteristics needed, application areas and processing of automotive hose.

30 Rubber microstructure and reversion

by Dr. K.H. Nordsiek, Huls AG. In this article, the author discusses the fundamentals of reversion in sulfur vulcanized systems and suggests specific molecular architecture to minimize the problem.

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edited by Bob Samples, Akron Rubber Development

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New equipment, instruments, CAD/CAM, products and materials

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Cover

Cover photo courtesy of Dow Chemical

A Lippincott & Peto Publication

Editorial

Thermoid Inc.'s president Robert J. Lyons uttered some sobering comments about the state of the industry when he spoke at a recent Rubber Manufacturers Association meeting. "There is not going to be any dramatic market growth in this country during the next decade. Many markets may not grow at all. So, either we are going to make it on our existing market, or we don't make it," Lyons said. "The numbers just aren't there. Many markets are mature, in fact they are suffering from old age. Many will even slip backwards. We should not be misled by the current position of the dollar and think that imported products will decline," he told the Industrial Products Division's annual gathering. At the meeting, the annual report for the division was given, showing a growth rate of 2-3%, and Lyons took exception with the figures. "I'd like to know where this growth is going to come from," he said. The traditional markets, automotive, oil, housing and construction do not appear to Lyons as areas of growth, but he and his company are not going to pack it in. He sees opportunities through all of this gloom and doom and the strategy is not revolutionary. In fact, the strategy has been forced upon many companies in the industry who have restructured their operations, mostly through threats of unfriendly takeovers. It involves controlling all costs, trimming the fat so to speak.

The theme is not new, but appears to have fallen on deaf ears in many quarters. It's a similar situation to another control that is now being practiced throughout the industry, statistical process control. SPC wasn't exactly embraced when it was first developed, in fact many in the industry felt it was forced upon them. Similarly many of the recent restructurings were forced on companies, while few recognized the advantage of being lean and mean. But just as SPC became a necessity, controlling all costs has become a necessity. Lyons said his company learned the critical importance of controlling all costs that were controllable - labor, manufacturing, marketing, sales, administrative and financing. He said they found some surprising answers, such as administrative costs and indirect labor costs far outweighed the cost of direct labor and that instead of carrying inventories for 120 days they were better off buying equipment that reduced the labor necessary to make a product.

Much of this is not popular according to Lyons but something that has to be done to remain competitive. Managers must decide where there markets are and assess the potential for growth. It may force decisions that many don't want to face. Managers can decry the government, foreign competition, labor and foreign investment as the problems, but those obstacles may be permanently in place and are items you may never totally have in control. But just as SPC has shown to be able to control the production process it is possible to control the costs that Lyons mentioned. Lyons concluded: "Once you slice away the fat and get close to the bone, you'll find it is a pretty decent way of doing business. Most important, it's a profitable, cleaner, leaner way of taking care of business until someone discovers a way to sow another crop of growth markets."

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Business Briefs

Acquisitions, expansions

Mobay Corp. has agreed to acquire **Denka Chemical Corp.** pending the approval of the appropriate government agencies. Denka, headquartered in Houston, TX, is a petrochemicals manufacturer with plants in Houston, Duluth, MN and Carteret and Little Ferry, NJ. Denka manufactures polychloroprene, maleic anhydride and its derivatives and tetrahydrophthalic anhydride. Since 1984 Denka has been owned by the management and employees. The Denka group also includes **Staflax Specialty Esters**, Carteret, NJ, a plasticizer producer and **Scientific Design of Little Ferry**, NJ a producer of catalysts.

Durox Co. is tripling rubber molding capacity at its headquarters in Strongsville, OH.

Beckers Lay-Tech, a Swedish-owned company, opened a plant to manufacture acoustic and related interior trim products for the automotive industry in Springfield, TN.

Hercules Inc. opened a coatings and additives center adjacent to the company's marketing center in Wilmington, DE, to centralize the business, marketing, technical and sales staffs of the coatings and additives group.

Hydraulic Engineering Inc., Jacksonville, FL will purchase **Goodyear's Hose Couplings Manufactur-**

ing Inc. subsidiary. HCMI has facilities in Menominee, MI and Dixon, IL.

Lonza Inc. broke ground for a multi-million dollar expansion at its specialty chemicals plant in Williamsport, PA.

Ashland Chemical acquired **Berton Plastics**, Teterboro, NJ, a distributor of glass reinforcements and unsaturated polyester resins.

ICI Fibres plans to acquire a fiber manufacturing subsidiary of **Veba Oel** located in Neumunster, West Germany.

A new Institute of Polymer Technology and Materials Engineering has been formed at **Loughborough University**, Leicestershire, England, which will be concerned primarily with postgraduate teaching and research.

Tenney Engineering, Union, NJ purchased the assets of **DynaVac**, Weymouth, MA, a manufacturer of custom thin film deposition equipment, computer-controlled optical coating systems, sputtering equipment and chemical vapor deposition systems.

Lydall, Inc. of Manchester, CT, plans to restructure the company by dividing it into two public companies, one consisting of the Fiber Materials Group and the other consisting of the Elastomers Products Group and Lydall's investment in the **CompuDyne Corp.**

RMA tire report through August
(figures in thousands of units)

Passenger tires	YTD '87	YTD '86	% change
Shipments			
original equipment	35,602	36,630	-2.81
radial	30,191	30,770	-1.88
replacement	97,243	94,498	+2.90
radial	86,858	81,329	+6.80
export	3,703	2,529	+46.42
radial	3,226	1,919	+68.11
total	136,548	133,657	+2.16
radial	120,275	114,018	+5.49
Production	110,607	104,867	+5.47
radial	96,905	88,621	+9.35
Truck & bus tires			
Shipments			
original equipment	5,265	4,643	+13.40
radial	3,656	3,087	+18.43
replacement	22,337	20,801	+7.38
radial	11,946	9,876	+20.96
export	1,285	868	+48.04
radial	909	531	+71.19
total	28,887	26,312	+9.79
radial	16,511	13,494	+22.36
Production	23,326	20,374	+14.49
radial	13,202	9,847	+34.07

Contracts, licenses

Monsanto Chemical and **Kumho Petrochemical**, Seoul, Korea have formed a joint venture to produce rubber chemicals in Korea. **Kumho Monsanto**, a 50/50 venture, will use Kumho's existing rubber chemicals plant in Yeochun as its base. It will also build a new plant to make intermediates used in antidegradant manufacturing. Plans also call for the expansion of Kumho's existing antidegradant units.

Smithers Scientific Services, Akron, OH has been designated a regional laboratory under international contract of technically specified rubbers according to the **International Rubber Association** in Malaysia. The **Rubber Research Institute of Malaysia** serves as the coordinating laboratory for the regional lab, ensuring Smithers is adequately equipped during its designated term, the length of which is determined by the IRA.

Union Carbide and **Swiss Polymers Inc.** formed a joint venture, **Elocar Co.**, to manufacture spray-dried redispersible polymer powders for the building products industry.

Whittaker Corp., Dayton Division will market cyanoacrylate and anaerobic adhesives manufactured by **Pacer Technology**.

Combustion Engineering, Stamford, CT has established a joint venture in the USSR to provide instrumentation and control products and develop software for the hydrocarbon processing industry. The venture, to be known as

Business Briefs

Applied Engineered Systems will be 49% owned by CE and 51% owned by the Soviet Union's Ministry of Oil Refining and Petrochemical Industries.

Midland Tyre & Tube Machinery, Wolverhampton, U.K. signed an agreement to manufacture and market the complete Zelant Gazuit range of fabric and steel bias cutters and associated equipment.

Financial statements

Ausimont reported third quarter net income of \$10.5 million on sales of \$176.1 million.

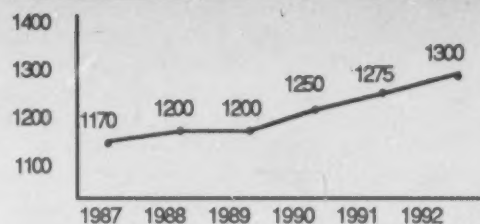
Park-Ohio Industries reported a net loss in the third quarter of \$1.04 million. Sales totaled \$31.2 million.

Markets, news

The Rubber Manufacturers Association's Industrial Products Division five year forecast calls for growth rates in the 2% range for hose, flat and V-belt consumption in the U.S. Hose consumption was pegged at \$1.1 billion for 1987 rising to \$1.3 billion in 1992; flat belting consumption will increase from \$374 million to \$404 million and V-belt consumption should increase to \$525 million from \$480 million in 1987. The division noted that imports could increase penetration of the market in all three sectors. Through July of this year, hose imports had increased 5.6%; V-belt imports increased 9.8% and conveyor belting imports were up 8.5%. Canada accounted for 43% of the imports of hose. Japan is the top exporter of V-belts, accounting for more than a third of these imports and Switzerland is the top exporter of conveyor belting to the U.S. with more than 14% of the import market.

A study by Gabris International predicts that medical tubing will show the greatest increase in sales through 1991 with a growth around 18.6%. The study: *Plastics and elas-*

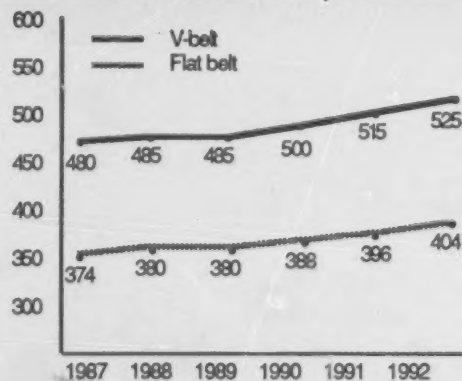
RMA U.S. hose consumption forecast
(millions of 1987 dollars)



tomers in flexible tubing U.S. & Western Europe shows growth also for the food and beverage market at 14.5% and the industrial market at 12.1%. Growth for flexible hose in the automotive market is slated for only a 7% increase. During this period, consumption of elastomer and plastic raw materials for flexible tubing will grow from approximately \$500 million in 1986 to \$640 million in 1991. The use of commodity thermoset rubber such as NBR, neoprene, epichlorohydrin and SBR will show declines in usage while NBR/PVC, CPE, CSM and silicone materials will increase. Thermoplastic elastomers will show a sharp increase in usage during the time period. Major growth will be experienced in styrenic, copolyester, olefinic and higher performance materials.

The International Natural Rubber Organization has begun selling from the buffer stock of rubber accumulated during the first International Natural Rubber Agreement. The amount to be sold is limited to what the buffer stock manager needs to finance the operations of INRO before a new agreement takes effect. INRA expired during October. The buffer stock had reached 360,000 metric tons.

RMA U.S. belt consumption forecast
(millions of 1987 dollars)



Flexible hose sales estimates for U.S.
and Western Europe (MM dollars)

	1986	1991	Growth
Consumer	\$158.25	\$175.00	10.5%
Automotive	290.00	310.50	7.0%
Industrial	484.00	543.00	12.1%
Medical	263.00	312.00	18.6%
Food & beverage	140.50	161.00	14.5%
Total	\$1,335.75	\$1,501.50	12.4%

Material type usage for flexible tubing

Material type	1986 demand (metric tons)	1991 forecast (metric tons)
Thermoset rubber	34,390	36,105
Thermoplastic rubber	8,085	10,768
Thermoplastic materials	226,732	248,990
Total	269,207	295,853

source: Gabris Int'l.

Automotive RIM market to grow 30% by 1990

by M.C. Cornell, Dow Chemical

Introduction

Since its commercial introduction in 1974, the Reaction Injection Molding (RIM) process has undergone significant improvements in both chemistry and equipment. These improvements have substantially reduced the cost and improved the quality of RIM parts. RIM is thus increasingly utilized by original equipment manufacturers to produce exterior automotive components; especially when large size, high surface quality, and/or part complexity are required. Additional mechanical and chemical improvements are under development which will further enhance the economic viability of RIM over alternate processes.

The improvements in RIM chemistry include the industry's conversion of chain extenders from glycols to diethyltoluenediamine (DETDA) for fascia, the commercial adoption of internal mold release (IMR) in these fascia, the development of polyurea chemistry for both fascia and body panels, and the use of glycol extended RIM systems for modular windows.

Truly structural RIM (MMRIM) parts are now in production because of the development of low viscosity, delayed gel isocyanurate and urethane chemistries which allow wet-out of preform reinforcements. While not yet capable of providing a "Class A" surface, large MMRIM parts are being considered for services as, for example, pickup truck box beds and bumper beams.

Automotive RIM markets

The North American automotive RIM market (for definition, RIM is considered to be the closed mold molding of high density [greater than about 0.7 specific gravity] articles from reactive liquids mixed by high pressure impingement; low density integral skin parts like steering wheels are not included) in 1987, estimated to be 61,000 metric tons (134 million pounds), reflects the increasing acceptance of RIM (table 1). This market is dominated by its use in flexible fascia, with use in body panels so far restricted to the Pontiac Fiero and Chevrolet Corvette. MMRIM has also found

Table 1 - automotive RIM market in North America

Application	1987 M-MTPA	1990 M-MTPA
Fascia	51.0	70.0
Trim	2.0	6.0
Body panels	1.0	3.0
Modular windows	5.5	10.0
MMRIM	1.5	3.0
Total	61.0	92.0

its first commercial application as spare tire covers for General Motors vehicles.

The most significant new automotive application of RIM is its use to mold gaskets in situ for modular window units (ref. 1). From initial production in 1984, modular window molding via RIM has grown as projected to exceed 5,500 metric tons (12 million pounds) annually.

The North American RIM market is approximately 57% of a global consumption of RIM chemicals estimated to be 106,000 metric tons (233 million pounds), with Ja-

pan having the next largest use of the RIM process (table 2).

RIM use in Japan has been dominated by the production of polyurethane fascia, which have been selected over other materials because of proven high quality in complex parts. Japanese use of RIM in body panels, structural composites and modular windows is being explored for future vehicles.

Europe has been more conservative in its use of RIM fascia; due, in part, to the diversity of impact requirements, styling and market expectations. Existing RIM dispensing equipment has traditionally been designed for relatively low delivery rate, matching the reactivity of initial RIM chemistry based on glycol chain extension. This low output equipment restricts the use of higher reactive but more productive chemistry. The European tendency is to use RIM for lower volume specialty applications such as body side moldings, wheel arches and air dams (front spoilers).

By 1990 the North American RIM market is projected to grow to 92,000 metric tons (202 million pounds), due primarily to growth in both the size and number of RIM fascia produced and to the planned increased use of RIM modular windows (table 1). A significant aspect of this growth is the captive RIM fascia production by Japanese auto manufacturers to supply their new North American operations. The selection of the RIM process over injection molding is a reflection of both the higher quality and economic benefits of advance RIM technology.

An increased use of RIM in trim parts, following the European tradition, is emerging in the United States and Canada. Because such trim parts provide desired styling differentiation, this application is expected to grow in the 1990s.

Little growth is forecast for RIM body panels or MMRIM through 1990 in North America. The only committed new program is the General Motors "GM-200" mini-van (1990 model year) which has specified polyurea RIM

Table 2 - global automotive RIM market

Region	M-MTPA
North America	61
Japan	22
Europe	19
(Fascia, 7 M-MTPA) (Trim, 12 M-MTPA)	
Other	4
Total	106

fenders (ref. 2). Other body panel programs under development are targeted for commercialization in the early-to-mid 1990s.

Future growth in RIM production outside of North America is more difficult to quantify because few new applications are publicly committed. However, certain trends are noteworthy:

1. In Japan, both custom and captive RIM producers are qualifying state-of-the-art RIM fascia chemistry based on DETDA and IMR. In some cases this chemistry will first be used to mold fascia at affiliates in the United States using advanced, high output, dispensing equipment. Plant expansion in Japan is then planned to use both this advanced chemistry and equipment.

2. While only one modular window program is committed by a Japanese automobile manufacturer, several development programs are in progress. The same scenario exists in Europe, where a modular window set is being produced for Fiat. Other European auto glass manufacturers have modular window prototyping programs in progress with several automobile companies.

3. New RIM plants in Korea and Brazil have begun production of bumpers and fascia to serve their domestic market and to export to North America.

4. As in North America, RIM body panels and MMRIM composites are being examined for use in the 1990s.

References

1. Carswell, R. and P. J. Kubizne. "Polyurethane RIM Modular Windows - A Synergistic Combination of Polymer, Process and Application," 29th Annual Technical Marketing Conference, Polyurethane Division, The Society of Plastics Industry, Reno, Nevada (October 23-25, 1985).
2. Vanderhinder, J. A. "Polyurea RIM Body Panels for On-Line Painting," Polyurethanes World Congress 1987, Aachen, West Germany (9/29-10/2, 1987).

SPI Polyurethane Division issues paper call

The Polyurethane Division of the Society of the Plastics Industry, Inc., has announced a "Call for Papers" for its 31st Annual Polyurethane Conference, being held October 18-21, 1988, in Philadelphia, Pa., at the Wyndham Franklin Plaza Hotel.

The Polyurethane Division will consider papers that address all phases of flexible foams, elastomers and RIM, and encourages papers that emphasize marketing or possible end-use applications of polyurethane technologies.

Suppliers, manufacturers, customers and end-users of polyurethane materials, products, machinery or equipment are invited to submit abstracts of proposed papers by February 11, 1987.

"We're introducing an exciting new aspect of the conference next year consisting of concurrent marketing and management sessions," said Jim Giroux, Communications Committee chairman.

These sessions will cover such areas as advertising, direct mail, telemarketing, public relations, special events, em-

ployee relations, legal issues, quality management, productivity, strategic planning and customer service.

"The Polyurethane Division encourages persons or organizations willing to share their expertise in any of these marketing and management areas to submit a description of a successful plan or project," Giroux added.

As it has in the past, the conference will provide an international forum for exchanging the latest information on chemical and technical innovations and on environmental issues of interest to the polyurethane industry.

To receive a form to submit an abstract of a proposed paper, or to obtain more information on next year's conference, contact Fran Lichtenberg at: Polyurethane Division, The Society of the Plastics Industry, Inc., 355 Lexington Avenue, New York, NY 10017; (212) 351-425.

PMA has speakers available for cast polyurethane elastomer presentations

The Polyurethane Manufacturers Association (PMA) has announced the availability of spokesmen to address various groups on the advantages of custom-molded polyurethane as a problem-solving alternative to conventional materials such as metal, wood, rubber and plastics in a variety of applications.

Targets of PMA's Speakers Bureau program include engineering societies, corporations, military groups, colleges, universities and other technical groups interested in increasing their knowledge of the unique properties and applications available through the use of polyurethane.

The Speakers Bureau is part of PMA's 5-part marketing drive which includes: 1) distribution of PMA's new "Polyurethane Applications Guide," a folder of information on polyurethane advantages and applications, including case histories and a list of PMA member company contacts; 2) an association advertising program aimed at engineers; 3) member company coordination of ads with the PMA program; and 4) a publicity service for distribution of PMA member company news releases through the Association's headquarters.

To schedule Speakers Bureau engagements, please contact the PMA office: Building C, Suite 20, 800 Roosevelt Road, Glen Ellyn, IL 60137; 312/858-2670.

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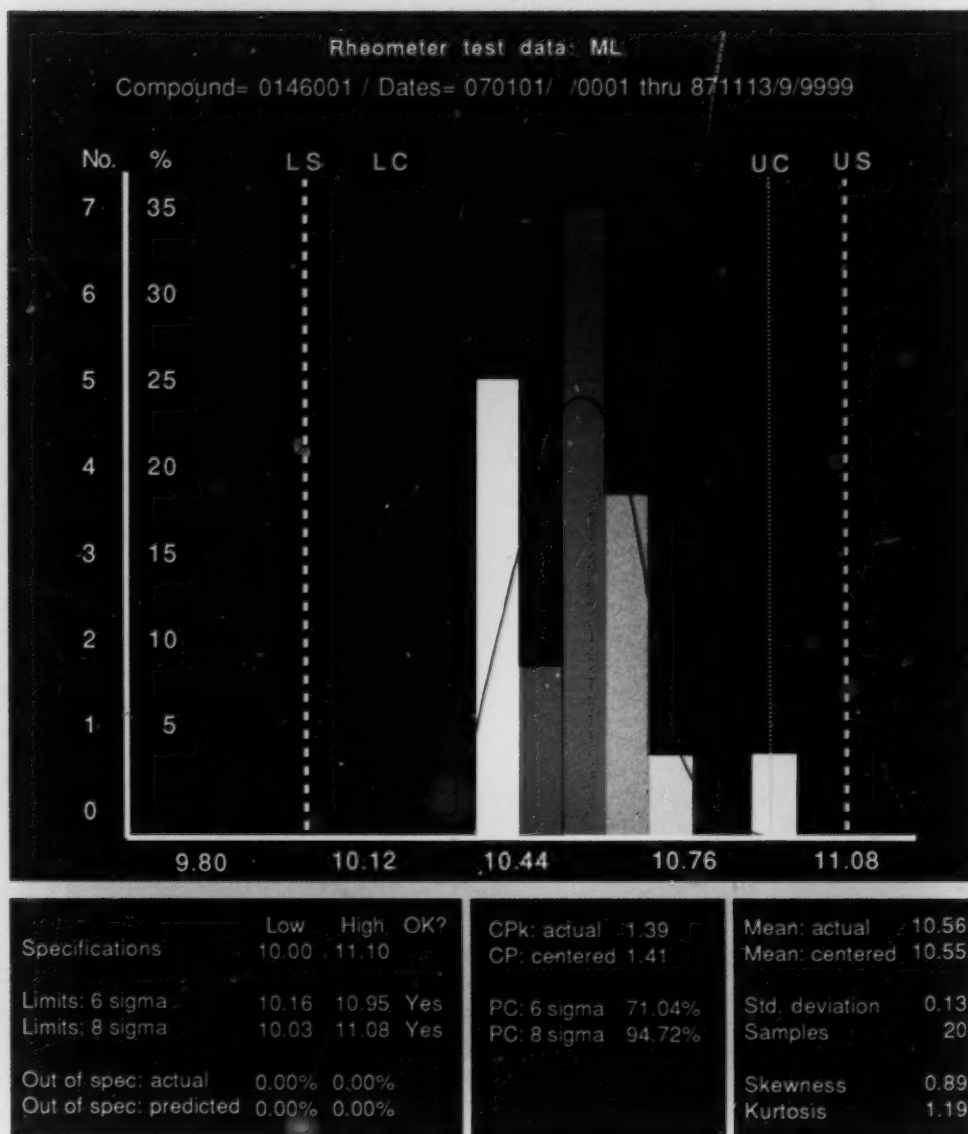
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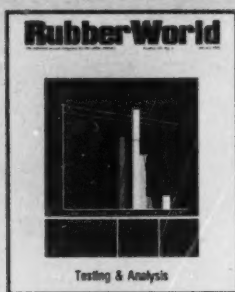
The technical service magazine for the rubber industry

Volume 197, No. 4

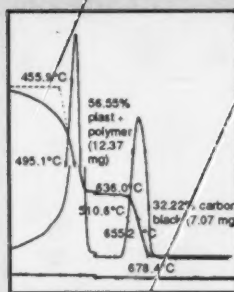
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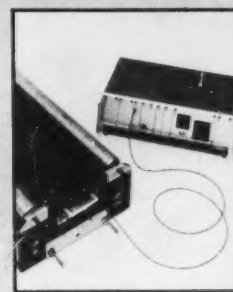
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by Jon Menough, contributing technical service editor. A look at rebuilding instrumentation and testing equipment used in the rubber industry.

12 Urethane Forum

This month's column features news items from the urethane industry.

14 RheoLogic software - a tool to assist in the SPC of rubber mixing

by Stephen Russo, Vernay Laboratories, and Patrick J. DiMauro and John I. Braver, Monsanto Instruments. The authors discuss how the addition of a RheoLogic package to the Monsanto oscillating disc rheometer has enabled Vernay Laboratories to move from having a standard piece of test equipment into having a valuable tool for improvement.

20 New laboratory procedures to evaluate the durability of roofing membranes

by Michael S. Farling, Carlisle SynTec Systems. This article describes the features and advantages of using thermal analysis or thermo-analytical techniques to bridge the gap between test procedures for different polymeric membranes.

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Cover artwork, featuring a Monsanto ODR screen, recreated by Joan Colbert.

A Lippincott & Peto Publication

Editorial

In these days of rapid technological advances it's hard to imagine many companies are giving much thought to what the rubber industry will be like in the year 2020. Manufacturing in space, interplanetary travel and developing the ocean floor may be the major markets for present day companies. Will there be significant technological innovations that will effect the make-up of the industry? What's the next step after radial tires? Will there be tires that never wear out? What if hydroplane technology eliminates the need for tires? Technological breakthroughs are not planned. When they occur you must be versatile enough to take advantage. But in an organized society, many things that affect business are planned. The year 2020 is 32 years away. The Interstate Highway System in the U.S. was initiated 32 years ago. And although those that took part in its development could hardly foresee what travel would be like in 1988, they laid the groundwork for a transportation system that has had some real benefits for the rubber industry.

And now a couple of groups are looking toward 2020 to develop a consensus for a plan to meet the surface transportation demands of the early part of the 21st century. The American Association of State Highway and Transportation Officials in cooperation with the Highway Users Federation are conducting a program called "Transportation 2020" to help chart a course of action and is seeking input throughout the country. It seems imperative to our industry that we make sure that continued development and maintenance of the interstate highway system becomes a top priority with the federal government. Presently there is no future transportation policy other than to complete the Interstate Highway System. The current Surface Transportation Act expires in 1991. If you think there's plenty of time, consider that the federal government identified the need for a highway system linking the states back in 1939, 17 years later the Interstate System was designed and the financing mechanism put into place.

The highway system is but one option in transporting either people or goods. Air travel, railroads and waterways are other choices. The present highway system has made traveling by car or shipping by truck the preference of many. Highway travel has tripled since the IHS began in 1956. Travel has increased at more than 4% per year during this decade and grew by 17% between 1983 and 1987. Yet, Federal expenditures on highways in real terms are 13% lower now than in 1983. At present growth rates, highway travel will increase 60% nationally by the turn of the century and yet there is no plan to deal with this growth. The two aforementioned groups have seen the need and are developing a plan that they are going to submit to Congress in early 1989. They are looking for input and considering the major role ground transportation plays in this industry, input should come from many within the industry. A good portion of the growth in the rubber industry is dependent on the continued and increasing use of transportation on wheels. The industry should seriously take part in making sure a first rate highway system is maintained and expanded.

Don R. Smith
Editor

RubberWorld

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Business Briefs

Tire for sale to Japanese car manufacturers, and by General Tire for Toyo and Yokohama for the North American market.

Mobay Corp. will supply an advanced polyurethane elastomeric system to Toyota, U.S.A. for use in mold-

ing front and rear bumper fascias for the Camry 4-door passenger sedans.

PPG Industries and Sudamtex de Venezuela formed a joint venture to manufacture continuous strand fiber glass in Barcelona, Venezuela. The agreement involves purchase by the joint venture of the fiber glass operations of a Sudamtex subsidiary.

Smaltiriva, S.p.A. headquartered near Milan, Italy has reached a licensing agreement to supply Plasma Coatings, Inc. products throughout Europe.

BFGoodrich Co.'s Aerospace and Defense Division has been selected by the United States Air Force to develop and supply two new tire designs for the C-17, a new cargo plane being built by McDonnell Douglas to complement the C-5.

RMA rubber report through October (figures expressed in metric tons)

	YTD '87	YTD '86	% change
Total new rubber			
New rubber available	2,705,048	2,562,161	5.58
Imports	900,697	869,668	3.57
Exports	414,854	327,697	26.60
Apparent consumption	2,321,609	2,235,349	3.86
Total natural rubber			
Imports	666,581	658,626	1.21
Exports	29,782	31,804	-6.36
Apparent consumption	645,820	641,601	.66
% total new rubber	27.81	28.70	
Total synthetic rubber			
Production	1,804,351	1,692,493	6.61
Imports	234,116	211,042	10.93
Exports	385,072	295,893	30.14
Apparent consumption	1,675,789	1,593,747	5.15
Total SBR			
Production	699,464	649,397	7.71
Imports	67,959	81,768	-16.89
Exports	142,130	90,539	56.98
Apparent consumption	646,226	648,311	-.32
Total nitrile			
Production	56,086	51,176	9.59
Imports	13,086	10,136	29.10
Exports	11,126	9,902	12.36
Apparent consumption	56,005	51,668	8.39
Polybutadiene			
Production	306,063	289,038	5.89
Imports	68,466	46,398	47.56
Exports	51,036	17,565	190.56
Apparent consumption	328,060	305,838	7.27
Ethylene-propylene			
Production	210,776	198,190	6.35
Imports	5,517	4,133	33.49
Exports	38,557	38,246	.81
Apparent consumption	172,700	157,840	9.41
Butyl, polychloroprene, polyisoprene, silicone and other synthetic elastomers			
Production	531,962	504,692	5.40
Imports	79,088	68,607	15.28
Exports	142,223	139,641	1.85
Apparent consumption	472,797	430,090	9.93

Financial Statements

BASF Corp. reported third quarter earnings of \$1.1 billion on sales of \$16.5 billion.

Degussa Groups turnover for the 1986/87 year was 3,802DM for the chemical sector

The Firestone Tire & Rubber Co. reported net income of \$145 million on sales of \$3.9 billion for fiscal 1987.

Smith & Nephew announced earnings of £74.9 million on sales of £418.5 million for the third quarter.

RMA tire report through September (figures in thousands of units)

	YTD '87	YTD '86	% change
Passenger tires			
Shipments			
original equipment	39,930	41,395	-3.54
radial	33,888	34,818	-2.67
replacement	111,581	107,643	3.66
radial	99,876	92,766	7.66
export	4,244	2,933	44.70
radial	3,703	2,247	64.80
total	155,755	151,971	2.49
radial	137,467	129,831	5.88
Production			
radial	124,624	118,797	4.91
radial	109,402	100,394	8.97
Truck & bus tires			
Shipments			
original equipment	5,906	5,236	12.80
radial	4,102	3,486	17.67
replacement	25,515	23,797	7.22
radial	13,712	11,341	20.91
export	1,475	989	49.14
radial	1,048	696	50.57
total	32,896	30,022	9.57
radial	18,862	15,523	21.51
Production			
radial	26,514	22,985	15.35
radial	15,208	11,181	34.41

Rubber World

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February

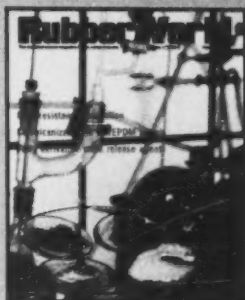
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Heat resistance evaluation

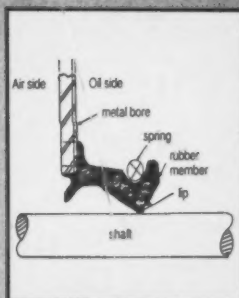
Co-vulcanization in NR/EPDM blends

Fatty derivative mold release agents

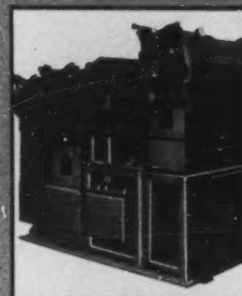




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- 28 Heat resistance evaluation for rubber compounds**
by Boris N. Dinzborg, Robert W. Keller and Robert Bond, CR Industries. The authors develop a systematic procedure, combining solid theory and innovative practice, for quantitatively assessing various vulcanizates for long life in automotive shaft seal applications.
- 33 Co-vulcanization in NR/EPDM blends**
by Singa D. Tobing, Servus Rubber Co. The author describes a patented blend, co-vulcanized with both sulfur and peroxides, which provides good ozone resistance and a unique combination of properties useful for footwear.
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by George N. Marakas, Witco Corp. This article describes a series of fatty acid derivatives finding unique advantages to enhance mold flow, allow lower operating temperatures and/or permit shorter cycle times in many compounds.
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Cover

Cover photo courtesy of The University of Dayton Research Center

A Lippincott & Peto Publication

Editorial

Requests to editorialize are nothing new. The daily mail usually brings a request from some person, organization, special interest group, etc. telling us we should write an editorial on... The phone many days brings a voice saying we should write an editorial on... When you go to meetings, invariably someone will buttonhole one of us and urge us to write an editorial on...

The requests vary. Some are legitimate. Many make you think, "just who does this person think reads this magazine?" One common request comes from various members of the Rubber Division and is similar to requests of members of the different rubber groups. They want more members and somehow think we can sway people to join. We appreciate the thought that we have that sort of influence, but what's puzzling is what can we tell those in the rubber industry about the benefits of membership in these organizations that any serious minded professional doesn't already know? The activities of the Rubber Division and the rubber groups are well documented in the rubber trade press. If someone decides that one doesn't have anything to offer him so be it. That person is not long for the rubber industry anyway. Persuading someone to improve one's knowledge in his career field seems unnecessary.

But you admire the persistence of those trying to increase membership. But maybe their results would be better if they targeted the company managements with their lobbying efforts. It seems that some of them aren't sold on the benefits of having their employees join and attend the various meetings that are offered. It's no coincidence that most of the successful companies have good representation at both the rubber group and Rubber Division. And most of these members take an active part within the organization. Companies may have their reasons for not actively encouraging employees to join, but no good ones have been brought forth. One disturbing excuse is that some companies view the meetings as chances for their employees to seek other employment. So start leaning on management. We support the Division and the groups and frankly find it incomprehensible that someone serious about their profession would not join, given the opportunity to attend the meetings.



Jill Wrigley

Jill Wrigley has been promoted to managing editor for both Rubber World and Automotive Polymers & Design. Jill has been with both magazines for three years and is also editor of Rubber World's Product News. Joining the staff as associate editor is Julie Wagner

Don R. Smith
Editor

RubberWorld

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Business Briefs

Acquisitions, expansions

BASF AG of West Germany has agreed to acquire all assets of the latex division of Polysar Ltd. Sale price is estimated at \$500 million (Canadian). Polysar's latex division has plants in Chattanooga, TN, Monaca, PA, Sarnia, Ont., Strasbourg, France and Arnhem, The Netherlands. Annual manufacturing capacity is approximately 220,000 tons. At Polysar France, BASF will enter into a long-term tolling agreement because the latex facilities cannot be separated from the rubber facilities.

Dunlop intends to establish a medium truck radial tire manufacturing facility in North America. The company is studying a number of locations, including the expansion of its existing plants in Buffalo, NY or Huntsville, AL. Production is expected during the third-quarter of 1989. The facility's output will reach upwards of 2,000 tires per day by 1991.

Avery Inc. said it intends to sell its Uniroyal Chemical subsidiary. Avery acquired Uniroyal Chemical in 1986.

Goodyear established a regional quality assurance laboratory in Akron, OH for testing materials used in the company's North American tire production.

Mobay completed its acquisition of Denka Chemical and renamed the operation Mobay Synthetics Corp. Headquartered in Houston, TX, the new Mobay unit has plants in Houston, Duluth, MN and Cateret and Little Ferry, NJ. Polychloroprene rubber is the main product manufactured along with maleic anhydride and tetrahydrophthalic anhydride. Mobay also completed a major expansion of research and development facilities at the company's headquarters in Pittsburgh, PA adding 50,000 sq. ft.

VMI Americas dedicated its new 26,000 sq. ft. facility in Stow, OH for the design and manufacturing of machinery for the tire and rubber industry.

Versa Machinery moved to a 22,000 sq. ft. plant in Branchburg, NJ, doubling its plant capacity for its downstream handling equipment.

J.M. Huber Corp.'s Calcium Carbonate division will construct a new calcium carbonate plant at Nolanville, TX, with start-up planned for the third quarter of this year.

Amax Inc., Greenwich, CT, acquired a substantial portion of the assets of Humphrey Chemical, Aberdeen, MD, to help Amax's expansion in the polymer market for flame retardants and smoke suppressants.

RPI/Dexter Plastics increased capacity by 40% with the completion of a \$3 million expansion to its purpose-built thermoplastic polyolefins plant in Grand Prairie, TX. Overall capacity for TPOs, blends, alloys and PVC compounds is now over 270 million pounds annually.

Legg Co., Halstead, KS, purchased the assets of American Rubber Manufacturing, Oakland, CA. The acquisition was for the operations only and does not include the plant. Legg plans to continue manufacturing custom-molded products and hose in Oakland, but it will relocate the conveyor equipment to Halstead.

Arco Chemical acquired more than 80% of the stock of Chiuglong Petrochemical Co., the only producer of propylene oxide and its derivatives in Taiwan.

ICI Specialty Chemicals has formed ICI Polymer

Gayson Silicone Pigment Dispersions

- ◆ customized systems
- ◆ specializing in FDA color selection

Silcopas

Pigments in silicone fluids
in paste form.

Silcogum

High pigment concentrations
as firm masterbatch

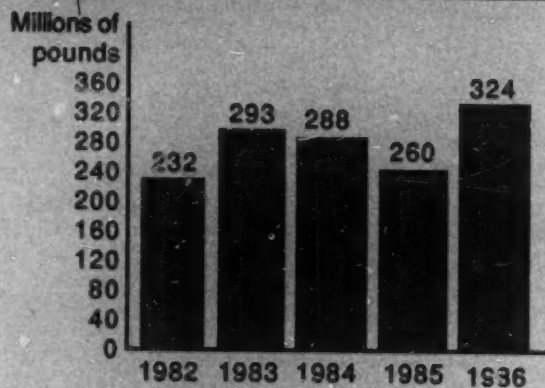
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Gayson, inc.

PO Box 222
Ringwood, New Jersey 07456
(201) 728-8100

Circle 5 on card

U.S. production of rubber processing chemicals



Source: International Trade Commission

Business Briefs

Additives, combining a number of the company's activities in specialty polymer additives into one organization dedicated to the supply of additives for solving problems.

Findlay Industries opened a 20,000 sq. ft. development facility in Troy, MI, for its automotive trim products. Findlay and **Woodbridge Foam** of Ontario, Canada, in a joint venture, purchased the **Allen Industries** manufacturing unit of **Day Corp.** Allen, an automotive trim manufacturer has facilities in Compton, CA, El Paso, TX, Rochester Hills, MI and Chihuahua, Mexico.

H. Heller & Co., a supplier of raw materials, opened a Rubber Division in Findlay, OH.

Air Products and Chemicals will construct a \$5 million new product development laboratory at its Pace, FL chemicals complex. The facility will produce drum quantities of new or improved amine-based products for customer testing and evaluation.

National Wax, Skokie, IL, purchased the assets of **Paragon Wax Refining**, San Francisco, CA.

Detroit Testing Laboratory, Oak Park, MI expanded its mechanical test services department to include 3,000 sq. ft. of facilities dedicated to fuel system component testing.

Emery Chemicals successfully completed the second phase of a debottlenecking in the manufacture of azelaic acid.

UCB S.A. acquired **Medical Industries Inc.**, Bloomfield, CT, a converter of flexible films specializing in the sterile packaging of medical products.

Contracts, licenses

Shell Chemical and **Japan Synthetic Rubber** have formed a joint venture to market solution styrene-butadiene rubber to the U.S. tire industry. The new venture will be called **Deltadyne Solution Elastomers**. The SBR will bear the tradename **Deltaflex** and will be supplied by the partners' affiliates in Europe and Japan and inventoried in the U.S. The partners also will evaluate the possibility of establishing a domestic manufacturing base.

BFGoodrich and **Dunlop Malaysia** have formed **BFG Sime Aerospace Services** in Kuala Lumpur, Malaysia. New aircraft tire production and aircraft tire retread operations will be done at an existing Dunlop Malaysia plant and the tires will be sold under the BFGoodrich brand. Dunlop Malaysia is part of **Sime Darby**.

TSE Industries, Clearwater, FL has added **Sovereign Chemical**, Cuyahoga Falls, OH and **A & M Chemical**, Indianapolis, IN as sales representatives for its millable polyurethanes. **C.P. Hall** remains as distributor for the western states.

Chemical Exchange Industries, Houston, TX and **Du Pont** signed a long-term agreement whereby CXI will refine and market hexamethyleneimine, a co-product of hexamethylene diamine, a nylon 66 precursor.

Mitchell, Inc., Elkhart, IN signed rep agreements with

Chemrep, Inc., Palatine, IL; **Barchem Associates**, Atkinson, NH and **Lescon, Inc.**, Flemington, NJ. The companies will make sales and service calls for Mitchell's cutters and grinders.

Resinall Corp. appointed **RJ Chemicals** as a sales agent for its hydrocarbon, modified rosin and rosin ester, rosin maleic and rosin modified phenolic resins.

Occidental Chemical appointed **Stochem Inc.**, Brampton, Ontario as exclusive distributor for its **Dechlorane Plus** line of flame retardant additives for Canada.

CHR Industries, New Haven, CT has added **Budnick Supply**, St. Louis, MO and **Matrix U.S.A.**, Clearwater, FL as distributors.

Financial statements

Arco Chemical reported net income of \$257 million on revenues of \$1.95 billion for 1987

Blasius Industries had a second quarter operating income of \$1.2 million on net sales of \$13 million.

Cabot Corp. reported a 1987 net income of \$29 million on sales of \$1.4 billion.

GenCorp reported net income of \$475 million in 1987 on net sales of \$1.6 billion.

Parker Hannifin reported second quarter net income of \$25.4 million on sales of \$529 million.

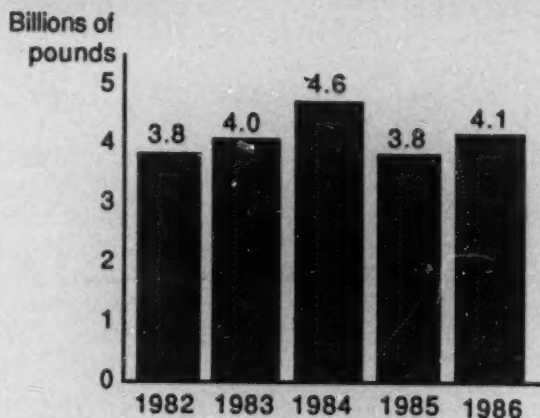
PPG Industries reported net earnings for 1987 were \$377.1 million on sales of \$5.18 billion.

The Standard Products Co. had a second quarter net income of \$7.7 million on sales of \$126.1 million.

Markets, news

Although 1987 reversed a trend that prevailed for several years, the International Institute of Synthetic Rubber Producers projects consumption of synthetic rubber to decrease

U.S. production of synthetic rubber



Source: International Trade Commission

Business Briefs

in North America by 1.5% in 1988. Robust tire sales and a healthy export market contributed to the 3.5% increase in consumption in 1987 according to the IISRP. They don't see that rate continuing, citing a slowdown in car sales being the chief factor in the anticipated reduction. The IISRP sees a 1.5% growth for the five year period from 1988 through 1992.

Although not included in the North American total, the IISRP has begun collecting data on thermoplastic elastomers. Consumption during the forecast period is expected to rise nearly 38%, a gain of over 6% annually. TPE consumption will account for more than 10% of all synthetic rubber polymers consumed in North America by 1992.

Goodyear predicts that total U.S. tire demand in 1988 should remain as strong as 1987, with slightly less demand for new car tires possibly offset by stronger replacement tire demand. Goodyear chairman Robert Mercer said the replacement market in 1987 at 150 million units is as big as it has ever been and 1988 should be as strong. Mercer said high performance radial tire demand reached 21 million units or nearly 11% of the tire market in 1987 and by 1992 output will be nearly 30 million. Original equipment tire sales in the truck tire market was near 3.3 million in 1987, 74% of that total being radial. 1988 sales are expected to reach the same level with radialization reaching 78% according to Mercer.

The United Rubber Workers adopted bargaining goals for

RMA tire report through October (figures in thousands of units)

Passenger tires	YTD '87	YTD '86	% change
Shipments			
original equipment	44,968	46,493	-3.28
radial	38,155	39,119	-2.46
replacement	126,625	121,445	4.27
radial	113,647	104,852	8.39
export	4,814	3,342	44.05
radial	4,205	2,567	63.81
total	176,407	171,280	2.99
radial	156,007	146,538	6.46
Production	140,229	134,028	4.63
radial	123,410	113,424	8.80
Truck & bus tires			
Shipments			
original equipment	6,646	5,833	13.94
radial	4,623	3,912	18.17
replacement	28,837	27,115	6.35
radial	15,668	13,010	20.43
export	1,686	1,098	53.55
radial	1,200	656	82.93
total	37,169	34,046	9.17
radial	21,491	17,578	22.26
Production	29,865	25,934	15.16
radial	16,925	12,698	33.29

Rubber end use percentage in tire and tire products

	U.S.A.	Canada	North America
Styrene butadiene - dry	71.8	81.3	72.5
Styrene butadiene - latex	11.1	12.4	11.2
Polybutadiene	73.3	80.0	73.9
Ethylene - propylene	4.3	8.7	4.4
Nitrile - solid	3.8	0.5	3.6
Other synthetic (*)	36.3	53.3	37.3
Total synthetic	42.0	49.2	43.0
Natural	72.4	72.2	72.3
Total rubber	49.6	58.4	50.4

* includes polyisoprene and butyl source: IISRP

their upcoming negotiations with the "Big Three" rubber companies. Contracts with Firestone, Goodyear and Uniroyal Goodrich expire April 20, affecting 27,000 of the union's 110,000 members. Considerable measures were outlined regarding improving job security. In the area of plant closures and layoffs, the policy called for a plant closing moratorium during future agreements "except for conditions beyond the company's control." Also, the policy called for company commitment to making investments in the plant or plants covered by collective bargaining agreements with the goal of maintaining or improving competitiveness. Further, the policy called for "no outsourcing of products when those products are made, or are capable of being made by URW-represented plants." Other goals adopted included: a meaningful wage increase; maintenance of COLA clauses where they presently exist and extension of COLA clauses to those contracts that presently do not provide such protection, improved pension benefit levels for both active and present retirees; continued efforts toward the health care cost containment program which was adopted by the union's local presidents meeting in 1984; and opposition to unwarranted concessions.

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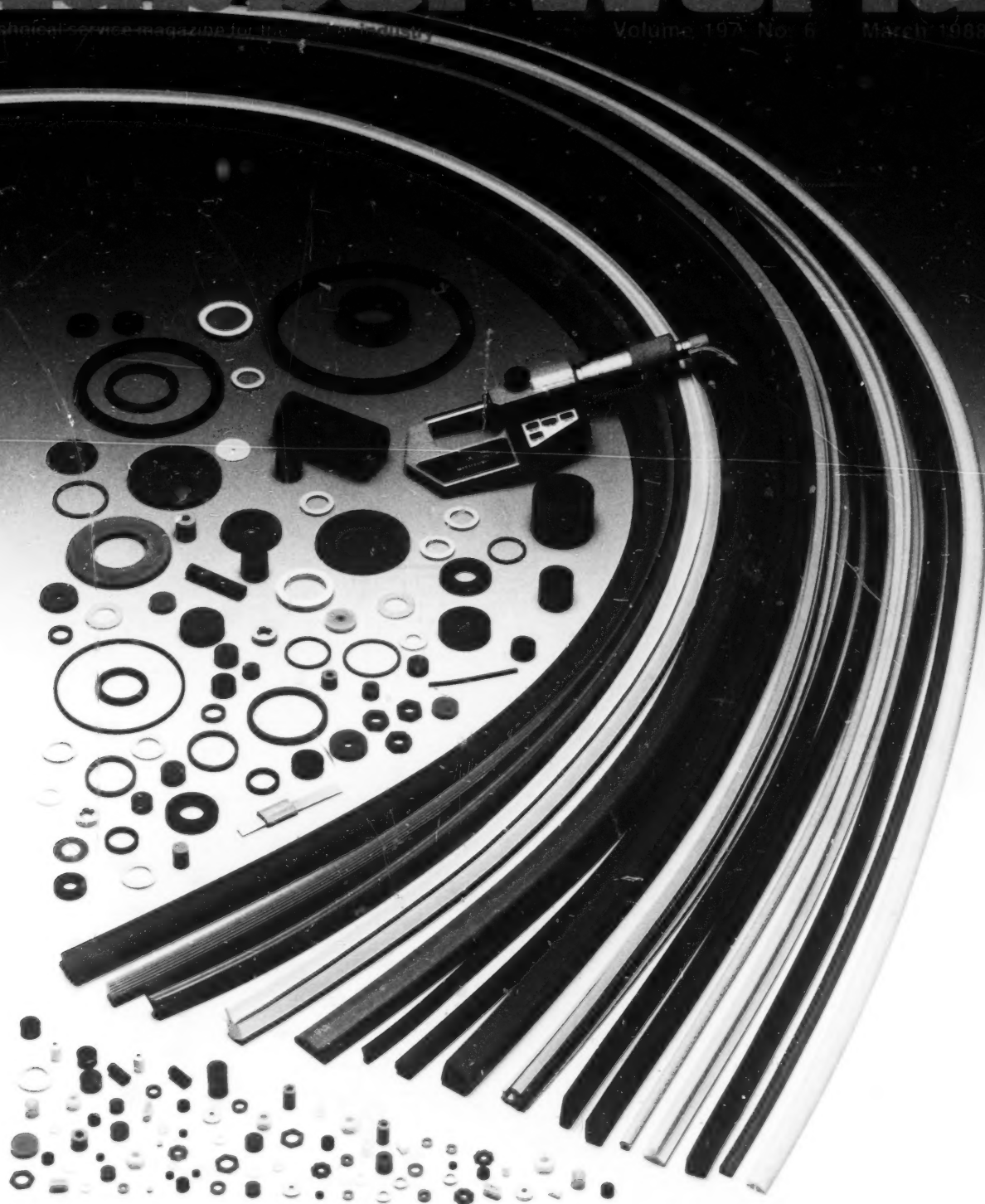
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RubberWorld

The technical service magazine for the rubber industry

Volume 197 No. 6 March 1988

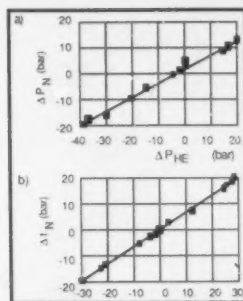


Profile extrusion • Process control evaluation

**Peroxide crosslinking vs
sulphur vulcanization**



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Acquisitions, expansions; contracts, licenses; financial statements; markets, news.

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by Jon Menough, contributing technical service editor. Developments in new adhesive systems enabling TPEs to be bonded to substrates including metals, fabrics and other elastomers will widen the applications for TPEs.

12 Urethane Forum: In-mold bonding expands RIM's versatility

by Stephen A Westley, Lord Corp. Urethane adhesives are opening new markets for RIM manufacturers.

16 Profile extrusion and vulcanization

by Gerd Capelle, Hermann Berstorff GmbH and Peter Hunziker, Berstorff Corp. Profile manufacturers should develop machine optimization by analyzing parameters and their effects, and by concentrating on the application of process control systems.

26 Process control evaluation in accordance with automotive industry requirements

by Hans-Joachim Graf and S. Tarku, Klockner Ferromatik Desma. Authors show how direct observation of a process in an injection molding machine in action produces the best results and this can be accomplished in the lab.

33 Peroxide crosslinking: A strength/weakness analysis vs sulphur vulcanization

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Cover

Cover photo courtesy of Parker Hannifin Corp.

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Editorial

In recent years the cry from business to get government off its back has found many a sympathetic ear from the general public. In fact, Ronald Reagan's popularity can somewhat be attributed to his promise to do just that. And in the wake of this popularity, little is heard from those who want to put more governmental control on business. The claims from business is that regulations aren't needed, make us less competitive in the world market and all the work involved in complying with regulations is counterproductive. And the general public, aware of the excesses of big government, have lent their support to the business cause. But those days may be coming to an end, and it's not because the public thinks that putting more regulations on business is such a good idea. It's because business is giving off the perception that it can't control itself. Some recent actions by companies in various industries are going to bring about a demand from the people to put more government on the back of business, and when you think about it, business asked for it.

There are companies that do defense work that routinely falsify work records, pad bills and try to find out any way they can to get paid more money than is due them. They don't call it stealing, yet they demand the government go after welfare cheats who in a lifetime couldn't come close to the money they're ripping off from the government. There are companies who falsify safety records, disregard safety compliance laws and various other regulations that not only put their workforce in danger, but the general public as well. One of the worst examples of business disregard happened recently when a fuel storage tank ruptured on the Ohio River spilling fuel into the water, contaminating water supplies. Next to something like Bhopal, this is insignificant. Whether the companies involved didn't follow correct safety procedures is not the point here either. They purposely didn't try to injure anyone. But after the spill on the Ohio, companies knowingly and willingly dumped toxic chemicals into the river. According to the EPA, these companies were taking advantage of the mishap to rid themselves of waste to save money on disposal!

What's interesting about this is that there has been very little outcry from the business community condemning this act, which legally could be construed as attempted assault, if not homicide. There can be no justification for acts like these, and according to the EPA, it's not the first time that something like this has happened. It's bad enough that many feel industry pollutes the environment within the federal regulations, now we have industry purposely dumping carcinogens. The backlash and repercussions from this could put a real crimp on your business, whether you've generated any toxic waste or not. We're not attempting to paint all of industry as villains because a minority segment has such little regard for the quality of life and the environment. But this taints everyone in industry and a real effort should be made by the leaders in industry to put an end to such actions. If you don't want to do it because of your concern for the people and the environment, do it because the costs of the resulting regulations that will be imposed are prohibitive to remaining competitive.

Don R. Smith
Editor

RubberWorld

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Business Briefs

Acquisitions, expansions

Bridgestone Corp. has agreed to acquire 75% of **Firestone Tire**. Firestone will retain 25% of the company that will continue to use the Firestone name and will be headquartered in Akron, OH. The parties intend to establish supply and sourcing agreements covering tires that will be sold by the new company to Firestone's continuing automotive service business, and raw materials that will be sold by Firestone's continuing diversified products businesses to the new company.

Prior to this announcement, Bridgestone said it intends to relocate its corporate headquarters from Torrance, CA to Nashville, TN, near the company's tire manufacturing plant in LaVergne, TN.

Dow Chemical is spending \$9 million to modernize its seven styrene-butadiene latex plants in North America. The program will further enhance product quality as well as achieve greater product uniformity.

JMK International is constructing a \$2 million center dedicated to the application development of high performance silicone compounds and products for the automotive, appliance, construction and other markets in Weatherford, TX. The facility, which is expected to be completed in June, will also test and evaluate other elastomers which have potential to be key and complimentary to silicone in the development of future products.

Witco Corp. expanded production capacity by 40% for urethane dispersions at its Organics Division's Chicago, IL plant complex. The company also added state of the art laboratory equipment to perform critical measurements and evaluations of materials used in development and quality control.

Southern Clay Products is expanding its organoclay production facility in Gonzales, TX. The multi-million dollar expansion is expected to be completed in July and will increase capacity of existing rheological additive products and provide capabilities for new products.

Vulcan Equipment, a manufacturer of machinery for the tire retread and repair industry, acquired a third manufacturing facility in Toronto.

ICI Polymer Additives has installed advanced injection molding equipment at its Everberg, Belgium R&D laboratories. The equipment will facilitate the development of improved additives.

Ferro Corp., Cleveland, OH, acquired the assets of **Canadian Plastics Concentrates Ltd.**, Petrolia, Ontario.

Hanson Industries sold its Southern Resin adhesive facility in Thomasville, NC to **Southern Resin Inc.** a newly-formed corporation. Southern Resin manufactures

RMA tire report through October
(figures in thousands of units)

Passenger tires	YTD '87	YTD '86	% change
Shipments			
original equipment	49,316	50,626	-2.59
radial	41,901	42,599	-1.64
replacement	139,329	133,367	4.47
radial	125,385	115,429	8.63
export	5,370	3,696	45.29
radial	4,679	2,844	64.52
total	194,015	187,589	3.37
radial	171,965	160,872	6.90
Production			
radial	153,907	146,743	4.88
radial	135,695	124,472	9.02
Truck & bus tires			
Shipments			
original equipment	7,264	6,357	14.27
radial	5,071	4,273	18.68
replacement	31,738	29,938	6.01
radial	17,351	14,459	20.00
export	1,878	1,184	58.61
radial	1,340	706	89.80
total	40,880	37,479	9.07
radial	23,762	19,438	22.25
Production			
radial	32,642	28,363	15.09
radial	18,533	14,014	32.25



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Business Briefs

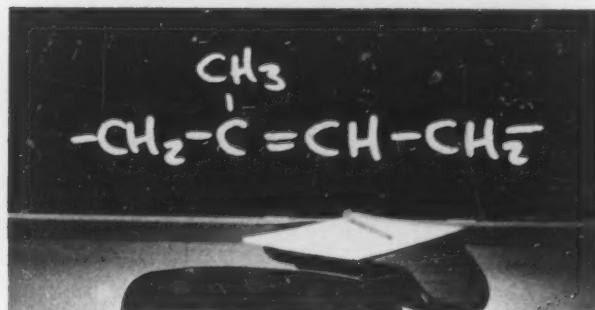
urea-formaldehyde adhesives.

Royal Rubber and Manufacturing, South Gate, CA is undergoing a \$3 million building expansion program and will make a major commitment to the automotive market with its floor mats.

Contracts, licenses

Thermoplastic natural rubber developed by the Malaysian Rubber Research and Development Board and the

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The Rubber Division is dedicated to an idea: For polymer scientists, engineers and technicians, a career is a lifelong learning process.

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Devised in cooperation with university professors, there are correspondence and classroom courses in Basic, Intermediate and Advanced Rubber Technology. Also provided are opportunities to attend frequent teaching symposia and workshops, and participants have unlimited access to technical papers.

For more information, write to: Education Committee, Rubber Division, ACS, The University of Akron, Akron, Ohio 44325 or call 216-375-7814 (Telex: 986434)

RUBBER  DIVISION

Malaysian Rubber Producer's Research Association will be manufactured in the United States by Teknor Apex, Pawtucket, RI and in Great Britain by Vitacom Ltd. These rubbers are partially dynamically vulcanized blends of Standard Malaysian Rubber and polypropylene.

Neville Chemical, Pittsburgh, PA appointed A.T. Callas Co., Troy, MI as a manufacturers representative for its line of hydrocarbon resins, plasticizers and antioxi-

RMA rubber report through November (figures expressed in metric tons)

	YTD '87	YTD '86	% change
Total new rubber			
New rubber available	2,978,771	2,78,231	6.95
Imports	991,476	947,152	4.68
Exports	458,161	359,920	27.30
Apparent consumption	2,550,272	2,431,889	4.87
Total natural rubber			
Imports	730,436	712,615	2.50
Exports	33,262	34,228	-2.76
Apparent consumption	706,445	692,374	2.03
% total new rubber	27.70	28.47	
Total synthetic rubber			
Production	1,987,295	1,838,079	8.12
Imports	261,040	234,537	11.30
Exports	424,879	325,692	30.45
Apparent consumption	1,843,827	1,739,515	6.00
Total SBR			
Production	772,772	717,313	7.73
Imports	77,417	89,615	-13.61
Exports	158,753	101,970	55.69
Apparent consumption	709,475	710,618	-.16
Total nitrile			
Production	61,800	55,440	11.47
Imports	14,591	11,021	32.39
Exports	12,384	10,928	13.32
Apparent consumption	61,461	56,351	9.07
Polybutadiene			
Production	338,459	306,198	10.48
Imports	6,285	54,013	39.03
Exports	43,231	20,687	168.90
Apparent consumption	190,482	333,755	8.17
Ethylene-propylene			
Production	231,459	214,900	7.71
Imports	6,285	4,325	45.32
Exports	43,231	41,199	4.93
Apparent consumption	190,482	171,962	10.77
Butyl, polychloroprene, polyisoprene, silicone and other synthetic elas- tomers			
Production	582,988	544,228	7.12
Imports	87,652	75,563	16.00
Exports	154,883	150,908	2.63
Apparent consumption	521,383	466,828	11.69

Business Briefs

dants.

Astor Wax Corp., Harrison, NY appointed Mid-States Resins and Chemicals, Chicago, IL, as sales representatives for its complete line of anti ozone waxes and lubricants.

Financial statements

Armtek Corp. reported a net income of \$20.5 million for 1987 on sales of \$1.19 billion.

Carlisle Companies had net earnings in 1987 of \$18.8 million on sales of \$542.7 million.

Cooper Tire reported 1987 net income of \$30.7 million on sales of \$665.8 million.

Firestone reported first quarter net income of \$30 million on sales of \$976 million.

Goodyear reported 1987 net income of \$770.9 million on sales of \$9.9 billion.

M.A. Hanna Co., Cleveland, OH had a net income of \$36.3 million in 1987 on revenues of \$496.7 million.

Park-Ohio Industries reported a net loss of \$3.07 million on sales of \$134.5 million.

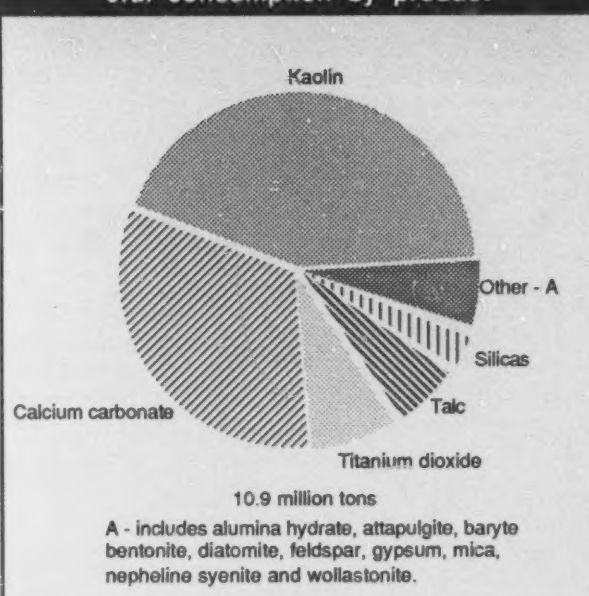
Rubbermaid Inc. reported 1987 earnings were \$84.5 million on sales of just over \$1 billion.

USG Corp. had 1987 net earnings of \$204.2 million on sales of \$2.8 billion.

Markets, news

The International Institute of Synthetic Rubber Producers in their five year forecast for Western Europe indicate that slow growth or even a slight decline in synthetic rubber

North American extender and filler mineral consumption by product



consumption can be expected due to the current economic climate. The IISRP says that capacities in the region remain well in excess of the expected consumption. For 1987, Western European synthetic rubber consumption was estimated to have risen 2.1% to 1.8 million metric tons. The group predicts an increase of 1.3% for 1988. With an annual growth rate pegged at 1.1% for the next five years, the IISRP sees consumption reaching nearly 2 million tons in the region. The growth rate for specialty rubbers during

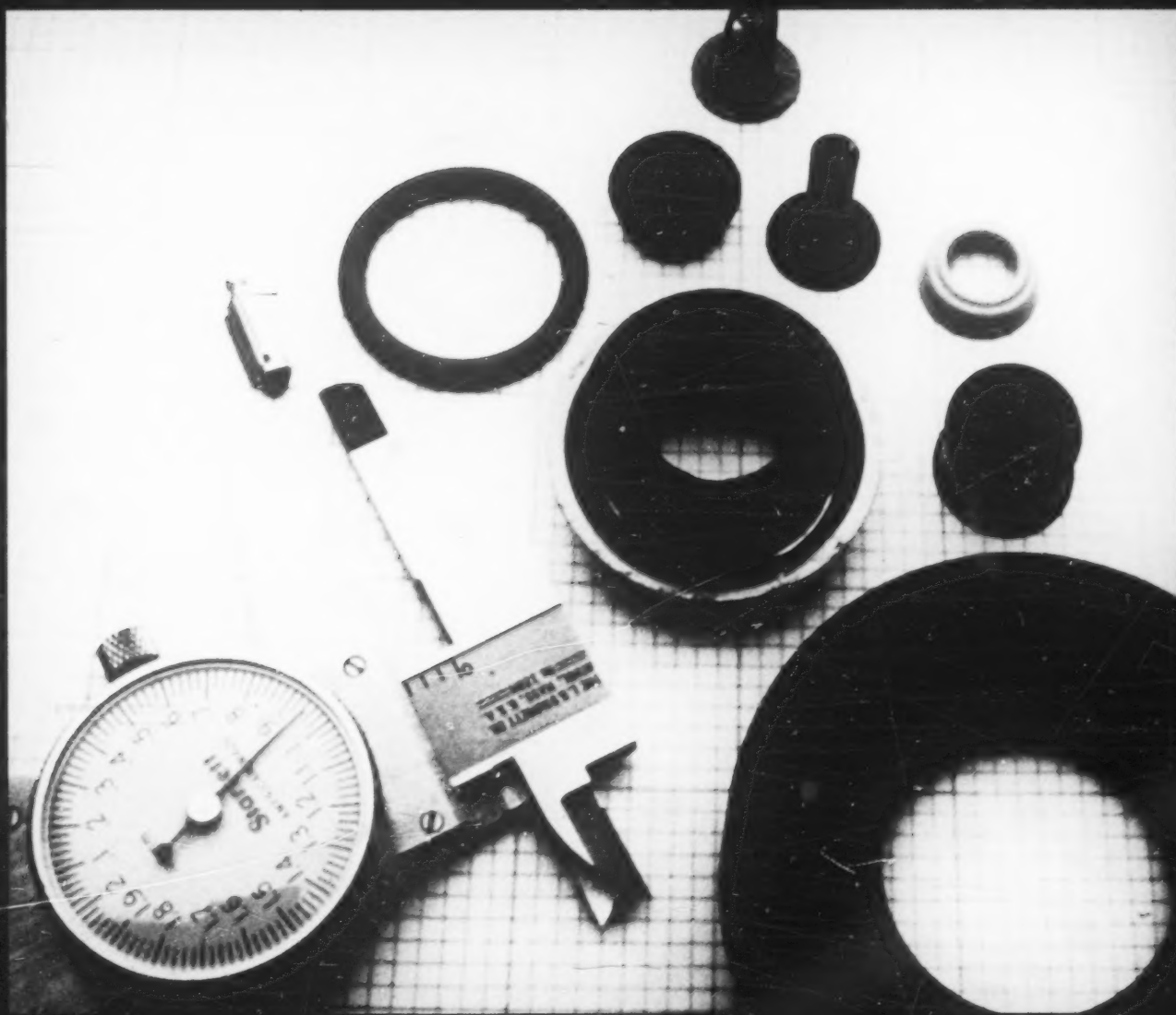
the period is expected to be 6.7% per year. Although thermoplastic elastomers are not included in the consolidated figures for synthetic rubber, the IISRP estimates TPEs now account for 7 1/2% of total rubber consumption in Western Europe. With a growth rate of 4.5% per year, TPEs are expected to reach about 10% of total new rubber consumed by 1992.

Consumption of extender and filler minerals in rubber reached \$180 million in 1987 according to a Kline & Co study. Consumption in the adhesives and sealants industry was listed at \$105 million and was marked as the second fastest for growth, behind plastics. Kaolin and calcium carbonate are the two dominant minerals used in North American extender and filler applications.

IISRP Western Europe new rubber consumption forecast
(all figures in thousands metric tons)

	1986 actual	1987 est.	1988	1992	1987 % tire/ tire prod.
Styrene butadiene - dry	605	612	618	640	67
Styrene butadiene - latex	110	115	110	105	5
Carboxylated SBR latex	310	335	345	370	-
Polybutadiene	236	240	244	257	72
Ethylene - propylene	162	170	175	195	-
Nitrile - solid & latex	80	81	82	85	-
Polychloroprene	82	81	81	77	-
Other synthetic (1)	222	216	220	244	56
Total synthetic	1807	1850	1875	1973	35
Natural rubber	903	945	955	980	66
Total new rubber	2737	2795	2830	2953	45
% synthetic	66	66	66	67	-

(1) includes butyl and polyisoprene



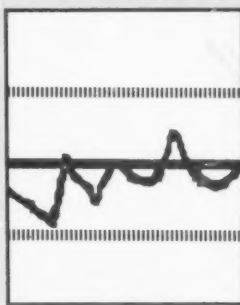
Management tools
for a quality process

Statistical approach to improving
testing and quality

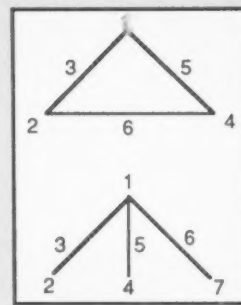
Design of experiments



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Acquisitions, expansions; contracts, licenses; financial statements; markets, news.

14 Tech Service: Quality systems - an outside look

by Jon Menough, contributing technical services editor. Development of laboratory manuals is of critical importance to developing a comprehensive quality program and to obtaining laboratory accreditation.

16 Urethane Forum

This month's column provides an overview of the Polyurethane Manufacturers Association's meeting to be held April 23-27 in San Diego, CA. The Structural Foam Division of the Society of the Plastics Industry, Inc.'s next meeting, to be held April 10-13 in Philadelphia, PA, is also reviewed.

18 A statistical approach to improving the testing and quality of synthetic rubber

by Colette M. Korosec, Polysar Ltd. The author describes a systematic way to improve the quality of the process of manufacturing synthetic rubber. She emphasizes the need to identify early the major contributors to variability and minimize their contributions.

26 Design of experiments in the rubber industry

by Oscar A. Ruiz, Copolymer Rubber & Chemical. This article shows how carefully designed experiments in the stage of lab evaluations can succeed in substantially increasing the product quality in production.

38 Management tools for guiding and measuring a quality process

by D.J. Adams, BFGoodrich. The author enthusiastically describes a way to lead an organization in implementing the four basic steps: See the goal; Sell the need; Set the plan; Solicit the feedback.

42 Patent News

edited by Bob Samples, Akron Rubber Development

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Cover

Cover photo courtesy of 3M Company.

Editorial

The following is a letter sent by Rubber Manufacturers Association president Donald Brotzman to Ambassador Clayton Yeutter, U.S. Trade Representative, concerning the possibility of the U.S. not ratifying the International Natural Rubber Agreement:

"Dear Ambassador Yeutter:

We are concerned that the administration may not seek funds for the new International Natural Rubber Agreement.

Industry officials have served on U.S. delegations and as advisors on INRA policy for many years. In the view of the board of directors of the Rubber Manufacturers Association, U.S. withdrawal from INRA, and the resulting liquidation of the large buffer stock, would be inconsistent with U.S. interests for the following reasons:

1. Commercial relations with other INRA member countries would be strained. The U.S. would be seen as reneging on negotiated commitments. Other countries could question our credibility, particularly since the administration achieved virtually all of its objectives in the negotiations, signed the new treaty, and sent it to the Senate for ratification. Our members supported these efforts and have publicly stated that the new agreement should be established quickly to avoid the adverse consequences of liquidating the buffer stock.

2. Forced liquidation of the buffer stock would disrupt markets, increase price volatility, and impair the efforts of our Far Eastern suppliers to implement sound investment policies. It is in the long term interest of the U.S.A. to have stable supplies and this requires consistent U.S. policy towards INRA.

3. The U.S. treasury could lose money if the INRA is liquidated. At present, the agreement is selling stock gradually at relatively high prices. If all buffer stocks have to be liquidated in a short period, the market would bid prices lower for INRA stocks and revenues would decline. This would be considered in relation to U.S. budgetary constraints.

The rubber industry hopes that this administration can find a way for the United States to continue to participate in the International Natural Rubber Organization."

Brotzman's letter is in response to reports that INRA funding may fall victim to cuts in the budget proposed by the administration. It would be understandable if the agreement was unworkable, as many claimed it would be when implemented in 1980. But that hasn't been the case. The buying and selling of rubber stocks according to world market prices, the major mechanism of the agreement, has worked. When prices fell sharply during the first half of this decade, the buffer stock manager purchased for the stockpile to keep prices up, and now with higher prices being posted, the manager is selling from the stockpile. As a result, producing countries have kept producing, instead of switching to more lucrative crops, and the consuming countries have had a steady supply of natural rubber at somewhat stabilized prices.

Being the largest consumer of natural rubber, it is more than in the best interest of the U.S. to ratify this agreement. We urge the administration to quit playing games and continue the process of ratification.

Don R. Smith
Editor

RubberWorld

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Business Briefs

Acquisitions, expansions

Bridgestone, appears to be the winner in the bidding for **Firestone**, the fifth largest tiremaker in the world. Bridgestone initially was to obtain 75% of Firestone's tire operations when the two companies went public with their negotiations. Italian tiremaker **Pirelli** offered to buy all of Firestone for \$58 a share, scuttling Bridgestone's deal. The Japanese company countered with an \$80 per share offer for the whole company and the offer was accepted by Firestone's board of directors. When the deal is completed, Bridgestone will become the third largest tire manufacturer in the world behind Goodyear and Michelin.

Polysar, through debottlenecking steps, is increasing ethylene-propylene rubber capacity to 35,000 metric tons annually at its Orange, TX plant. Work is expected to be completed in the first quarter of 1989. The company also announced it will bring on stream facilities at Orange to produce two new types of polybutadiene rubber. The new polybutadienes will be manufactured using a lithium catalyst. One will be a medium-vinyl BR rubber designed primarily for use in tire tread compositions and the other is an impact modifier for polystyrene plastics. When modification work is completed late this year, the plant will have an

initial capacity of 25,000 metric tons.

Dow Chemical is moving its Automotive Materials Group to expanded facilities in Southfield, MI. The Dow Automotive Center will serve as the U.S. focal point for the company's worldwide marketing, technical and applications developments resources when it opens in mid-1988.

Huls America is consolidating the chemical and plastics business of **Nuodex Inc.** and the **Dynamit Nobel America** group of companies. Huls acquired Nuodex in 1985 and DNA in 1987.

Arco Chemical restarted its styrene unit at Monaca, PA, and increased capacity at its Channelview, TX complex. The Monaca facility has a capacity of 210 million pounds per year. The Channelview expansion will increase capacity to 1.3 billion pounds per year. The company also completed an expansion of ethylbenzene production at Channelview, increasing capacity to 1.7 billion pounds per year.

Wacker-Chemie GmbH, Munich, acquired another 47% of its Italian sales and marketing subsidiary from its former partner **B.H. Schilling**. Wacker-Chemie now holds 97% of the shares.

The **UCB Group** of Belgium now controls 100% of **Quimica Iberica SA**, Madrid, Spain, a manufacturer of acrylic resins, resins for radiation curing and polyurethane resins.

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RMA tire report through December (figures in thousands of units)

Passenger tires	YTD '87	YTD '86	% change
Shipments			
original equipment	52,913	54,392	-2.72
radial	44,989	45,778	-1.72
replacement	151,892	144,267	+5.29
radial	137,048	125,102	+9.55
export	5,987	4,032	+48.49
radial	5,215	3,098	+68.33
total	210,792	202,691	+4.00
radial	187,252	173,978	+7.63
Production	167,522	159,350	+5.13
radial	147,825	135,444	+9.14
Truck & bus tires			
Shipments			
original equipment	7,845	6,859	+14.38
radial	5,495	4,631	+18.66
replacement	34,514	32,392	+6.55
radial	19,000	15,732	+20.77
export	2,069	1,302	+58.91
radial	1,483	773	+91.85
total	44,428	40,553	+9.56
radial	25,978	21,136	+22.91
Production	35,456	30,939	+14.60
radial	20,176	15,476	+30.37

Business Briefs

Degussa Group reported 1987 profit of 230 million DM on a turnover of 11.7 billion DM.

Essex Chemical reported a net loss for 1987 of \$16.6 million with sales of \$191.5 million.

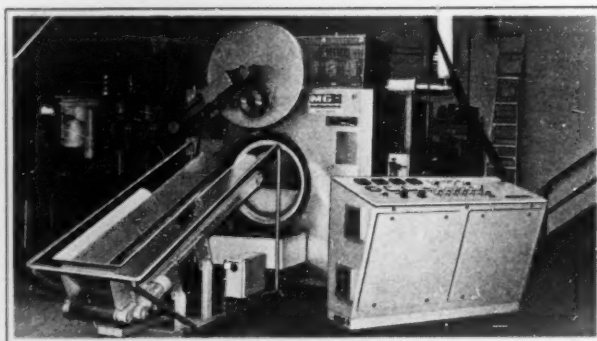
GenCorp reported first quarter net income of \$17 million on sales of \$468 million.

Lydall, Inc. had 1987 earnings of \$4.7 million on sales of \$134 million.

RMA rubber report through December (figures expressed in metric tons)

	1987	1986	% change
Total new rubber			
New rubber available	3,275,528	3,037,419	7.84
Imports	1,093,411	1,024,645	6.71
Exports	491,005	391,891	25.29
Apparent consumption	2,793,281	2,638,793	5.85
Total natural rubber			
Imports	810,824	769,345	5.39
Exports	36,996	36,473	1.43
Apparent consumption	775,824	743,563	4.34
% total new rubber	27.77	28.17	
Total synthetic rubber			
Production	2,182,117	2,012,774	8.41
Imports	282,587	255,300	10.69
Exports	454,009	355,418	27.74
Apparent consumption	2,017,456	1,895,229	6.45
	72.22	71.82	
Total SBR			
Production	850,365	791,501	7.44
Imports	83,277	95,843	-13.11
Exports	172,114	111,713	54.07
Apparent consumption	770,813	771,190	-.05
Total nitrile			
Production	68,541	59,309	15.57
Imports	16,175	12,311	31.39
Exports	13,369	11,915	12.20
Apparent consumption	68,060	61,501	10.66
Polybutadiene			
Production	371,349	336,364	10.40
Imports	81,964	60,417	35.66
Exports	60,816	23,708	156.52
Apparent consumption	394,449	366,814	7.53
Ethylene-propylene			
Production	254,062	229,629	10.64
Imports	7,138	4,460	60.04
Exports	47,228	45,107	4.70
Apparent consumption	208,885	186,463	12.02
Butyl, polychloroprene, polyisoprene, silicone and other synthetic elas- tomers			
Production	637,801	595,971	7.02
Imports	94,033	82,269	14.30
Exports	160,482	162,975	-1.53
Apparent consumption	575,251	509,261	12.96

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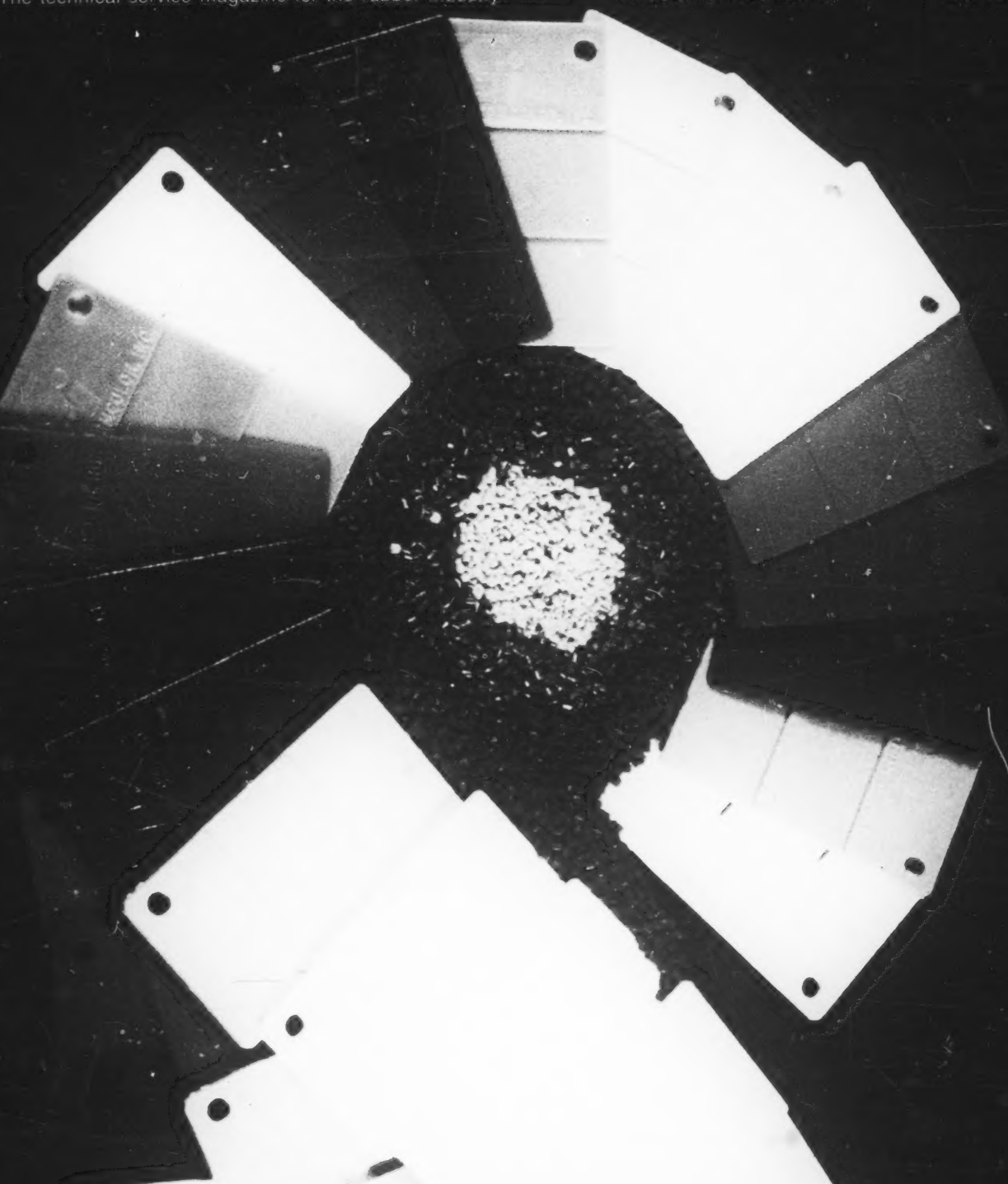
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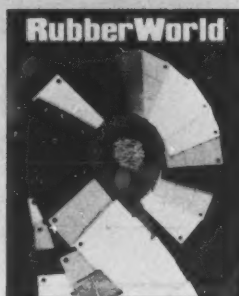
The technical service magazine for the rubber industry

Volume 198, No. 2

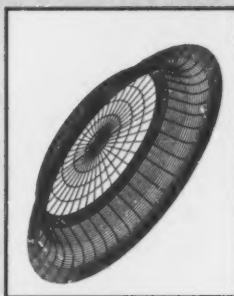
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by Jon Menough, contributing technical services editor. This month's column looks at applying load to rubber articles through shear.

15 Urethane Forum

This month's column focuses on a Rapra study on fire and combustibility of polymers, along with other news from the urethane industry.

17 Commercial and technical developments of liquid injection molding of silicone elastomers

by Dr. Aldo A. Laghi, General Electric Company. This article reveals how lower process costs and the high quality inherent with liquid injection molding have resulted in strong demand for liquid silicones in many industries.

20 On the transparency of elastomeric materials

by G.W. Lawless, University of Dayton Research Institute. The author discusses the unique functions of elastomers possessing visual transparency, such as in face pieces, flexible windows, protective coverings and measurement tubes.

24 How to process and prosper with TPEs

by Ray Pelle, DJ Inc. This article shares with the reader some observations on ways to use the advantages of TPEs effectively and profitably.

Unique fire protection using rubber-based materials

by Richard R. Licht, 3M Company. The use of a unique rubber compound based on chloroprene and intumescent technology is presented in this article.

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Cover photo courtesy of Teknor Apex.

A Lippincott & Peto Publication

Editorial

Remember the Big Five? Nowadays it's evolved into the Big Three and we didn't have the Big Four for that long. The use of these terms was convenient for those in the media because most knew what you were referring to. But with all of the ownership changes that have taken place, the term big anything should probably be laid to rest. There is a definite changing of the guard going on and it will be interesting to watch the developments in the tire industry as it pertains to the industry as a whole. How will labor and management get along? Management and management? What will be the participation of the new ownerships in such groups as the Rubber Division of the American Chemical Society, the Rubber Manufacturers Association and even the Rubber Groups?

Many of the technological advancements in the rubber industry have been spawned in the tire segment of research. And, through participation in the aforementioned groups, technology was advanced even further. But are the Michelins, Bridgestones, Pirellis, Sumitomos, Continentals et al going to participate in the Rubber Division and the Rubber Groups in the same manner as Firestone, General, Armstrong etc.? There's a lot more to these associations than just their technological exchanges. The infrastructures are staffed by volunteers whose management allowed and encouraged such participation - participation that's desperately needed to keep these groups operating at the level we have come to take for granted. We're counting on the new members of the North American rubber industry to recognize the importance of supporting the professional associations in the same manner as their predecessors.

Hopefully, the new ownerships that inherited union shops will have the same cooperation that has developed between labor and management recently. What has been lost in the news of companies changing hands is the fact that this is a contract year for many of the tire makers. Just mentioning that a contract year was coming up would send shivers through management. Elaborate strategies would be planned in case of work stoppages, which always seemed inevitable. But that fact of life is changing as well. The URW and Uniroyal Goodrich worked out a contract two months before expiration of the old one, and Goodyear and the union reached a tentative agreement without any work disruption. This marks the fourth consecutive set of companywide negotiations between the URW and Goodyear that has been settled without a strike. Much of this accord can be attributed to the strong performances of international tire companies, who now have become domestic manufacturers. And, all of the past agreements came within the framework of a pattern settlement for the Big Five on down to this year's Big Three. This system of pattern contract negotiations is ending too.

Changes are in store for all facets of the industry. From labor relations to research and development. We're hoping the transition is a smooth one.

Don R. Smith
Editor

RubberWorld

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Business Briefs

Acquisitions, expansions

Bridgestone's purchase of Firestone was approved by Firestone's board of directors clearing the way for the estimated \$2.6 billion takeover.

Harwick Chemical acquired the Carter Bell Mfg. Co. of Springfield, NJ, a manufacturer of vulcanized vegetable oils (VVO). The manufacturing of VVOs will be moved to Harwick's newly-expanded CMS Chemical division plant in Wynne, AR.

Goodyear is to build an advanced high-technology plant for the production of steel radial auto and light truck tires. The plant, to be located in Korea, is scheduled for completion in the spring of 1991 and will produce more than 3 million tires per year.

Polysar Asia Pacific opened a \$2 million technical center in Singapore's Science Park.

Teknor Apex will expand operations at its custom rubber mixing facility in Brownsville, TN by 50%. The expansion is expected to be on-stream by July 1, 1988. The company's headquarters plant is located in Pawtucket, RI.

Burton Rubber Processing completed a 60,000 sq. ft. rubber mixing facility in Tillsonburg, Ontario.

Allied Color Industries' custom color facility in Greenville, SC opened a 12,000 sq. ft. building, doubling its concentrate capacity. The company's headquarters plant in Broadview Heights, OH opened a 20,000 sq. ft. warehouse and production addition, increasing the company's facility to 65,000 sq. ft. With these additions, the company expects to increase production capacity by 70%.

The Bata Shoe Co., Belcamp, MD, has expanded its traditional rubber footwear manufacturing facilities into the commercial rubber compounding business for industrial parts. The expansion was called for by the company to fully utilize machinery and existing plant capacity.

JMK International, Fort Worth, TX, purchased the assets of Porter Seal Co. and its sister company, Advance Rubber Molding, Arlington, TX. The acquisition will enable the company to broaden its organic sealing base while continuing concentration on the design and fabrication of silicone sealing systems for the automotive and other industries.

Shell Chemical will modify an existing plant at its Deer Park, TX facility to purify isoprene monomer for use in the company's Kraton thermoplastic elastomers and Shellvis viscosity improvers. Field work will begin mid-1988 and will be completed in the fall of 1989, increasing plant capacity to 100 million lb./yr.

Goodyear has established a general products office in Tokyo. The office will have responsibility for original equipment automotive, technical, sales and engineering for Japan, Korea and Taiwan.

Amoco Performance Products acquired the Augusta, GA facility of Dartco and other assets and properties of its Xydar liquid crystal polymer business. The plant will continue as a manufacturing site for Amoco.

Ethyl Corp. will expand capacities of tetrabromobisphenol-A and methyl bromide by the third quarter of 1988. In addition, new plant construction to produce hexabromocyclododecane is expected to begin in the fourth quarter. The company is planning relocation of several of the bromine chemicals manufacturing units from Midland, MI to Magnolia, Ark.

Henkel Corp. will build a \$7 million technical center at its operations facility in Ambler, PA and will relocate its New Jersey based process chemicals business to the site.

General Plastex now has the capability to rebuild full-length bi-metallic barrels.

Dayco Products will relocate its headquarters to North Charleston, SC by spring of 1989. As part of a major restructuring program, the company's research and development activities will relocate from Springfield, MO during 1991.

Parker Hannifin has agreed in principle to acquire Stratoflex, the Fort Worth, Texas-based manufacturer of hoses and fittings. The terms provide for the payment of \$61.04 for each share of Stratoflex common stock.

N.V. Bekaert S.A. and the wire products division of the B.H.P. Steel International Group have formed a 50/50 joint venture for the development of the production of steel cord for the reinforcement of tires in Geelong, Australia.

RMA tire report through December
(figures in thousands of units)

Passenger tires	YTD '88	YTD '87	% change
Shipments			
original equipment	4,040	4,838	-16.5
radial	3,428	4,081	-16.0
replacement	10,648	10,494	1.5
radial	9,920	9,327	6.4
export	775	369	109.9
radial	672	316	112.6
total	15,463	15,701	-1.5
radial	14,019	13,724	2.2
Production	14,386	13,940	3.2
radial	12,994	12,074	7.6
Truck & bus tires			
Shipments			
original equipment	673	643	4.6
radial	485	453	7.3
replacement	2,413	2,387	1.1
radial	1,400	1,242	12.7
export	246	121	102.6
radial	189	86	119.3
total	3,332	3,151	5.7
radial	2,075	1,781	16.5
Production	2,959	2,939	0.7
radial	1,770	1,604	10.4

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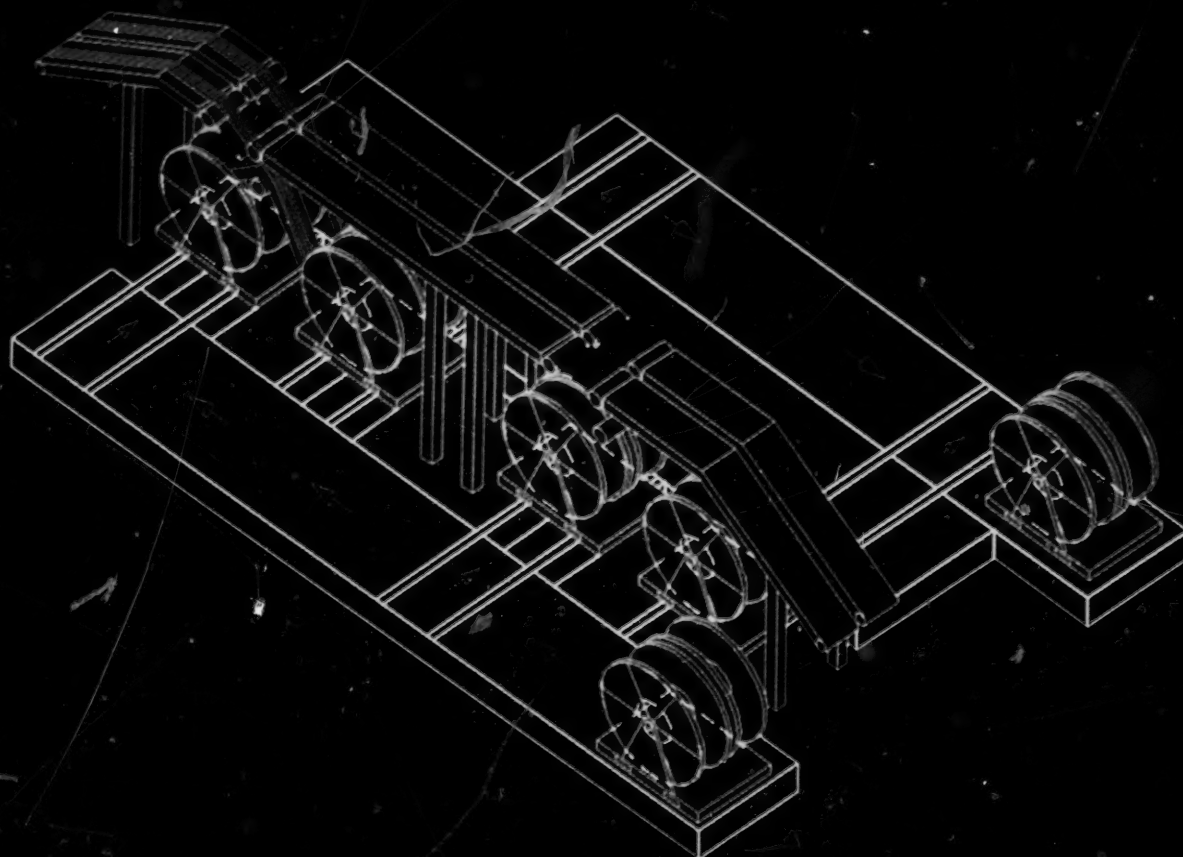
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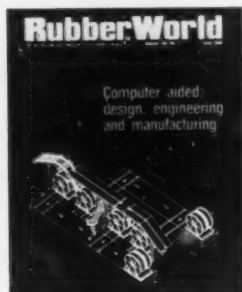
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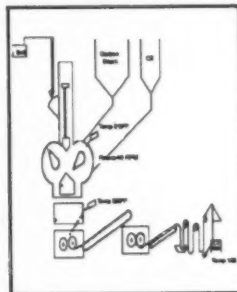
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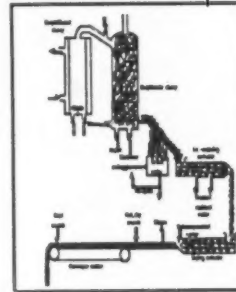




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Cover photo courtesy of General Tire.

A Lippincott & Peto Publication

Editorial

Without any discernible opposition to ratification of the International Natural Rubber Agreement, the Reagan administration's actions concerning the renewal are a mystery. After stating there wasn't any money appropriated for U.S. participation in the pact, the government reversed itself and said they found the funds and asked the Senate to ratify the agreement. Supposedly, funds already provided for support of buffer stock obligations under INRA I can remain available for INRA II. What purpose was served by indicating the U.S. wouldn't participate because it didn't have the dues?

Another international agreement that has little opposition is the Montreal Protocol, which deals with reducing ozone depletion by limiting the production of chlorofluorocarbons. This pact, universally accepted, will freeze and gradually reduce global CFC output by 50% before the end of the century. Du Pont, the world's top producer of CFCs, is phasing out production. This move should be applauded by all. Phasing out a \$600 million a year business is a tough decision. But Du Pont made a promise back in 1974 that it would cease production if scientific evidence linked the compounds with ozone depletion. Some are skeptical of the company's motives, claiming that substitutes for CFCs will be more expensive and probably more profitable, but that's not the issue. Du Pont made a responsible decision, even though they could have stuck to the position that the evidence is inconclusive. And it's good to see others, namely Dow and Pennwalt, phasing out CFCs as well. This shows a corporate responsibility that few in the public are aware of, and a positive move by the companies involved.

The Rubber Division of the American Chemical Society has made a number of positive moves recently, but there has also been a regression. Recently the Division instituted new awards to recognize accomplishments of people within the industry, in addition to the Charles Goodyear Medal Award. The Melvin Mooney Distinguished Technology Award, the George Stafford Whitby Award for distinguished teaching and academic research and the Fernley H. Banbury Award have been given the past two times around. But the fourth award, the Sparks-Thomas Award, was not presented at the most recent meeting. This award is to recognize and encourage outstanding scientific contributions and innovations by younger scientists, technologists and engineers. It's hard to image that no one in the rubber industry under the age of 40 qualified for this award. We know that the integrity of the awards is a concern to some, but we feel this is an important award and should be given on a regular basis, just like the others. Remember, the award is to recognize and encourage.

Don R. Smith
Editor

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Business Briefs

Acquisitions, expansions

Dunlop will invest \$70 million to \$100 million in a new medium truck radial tire plant at its Buffalo, NY facility.

Kelly-Springfield Tire is investing \$18.8 million for new mixing, stock preparation, tire building and curing equipment, along with a 29,000 sq. ft. addition to production space at its Fayetteville, NC tire plant.

Bridgestone has begun production of the first U.S.-made, Japanese-brand passenger radial tires in North America at its La Vergne, TN facility. Production will be approximately 6,000 passenger tires daily by 1989.

Goodall Rubber Co., Trenton, NJ has been acquired by **Trelleborg**, AB of Sweden and will operate as a wholly-owned subsidiary of Trelleborg.

GenCorp signed a letter of intent to purchase the assets of the extruded rubber division of **Bailey Corp.**, Seabrook, NH. The division manufactures vehicle sealing products.

Polysar Inc. completed the first stage of upgrading and expanding silicone rubber compounding at its Akron, OH facility. Dough mixers and automated take-off equipment are being added.

RM Engineered Products, North Charleston, SC, acquired **Newco Holz Rubber**, Lodi, CA, and renamed the aerospace/defense supplier **RM-Holz Inc.**

The Standard Products Co. will begin production of extrusion and trim parts for the automotive original equipment market this summer in the 85,000 sq. ft. plant in Spartanburg, SC, acquired from the **Hersey Products Corp.**

The clay division of **J.M. Huber** will invest \$100 million over the next four years in its kaolin mining and beneficiating facilities in two Georgia facilities.

Arco Chemical announced startup of a plant for flexible polyols with an annual production capacity of 125 million pounds at its manufacturing complex in Channelview, TX.

Hercules Tire & Rubber, Findlay, OH, acquired **Custom Engineering Design Co.**, Springfield, MO, a manufacturer of pre-cure retreading equipment.

Cyprus Industrial Minerals purchased **Vermont Talc**. Included in the acquisition were mines, mills, reserves and two processing facilities.

CR Industries acquired the assets of **Korody-Colyer Corp.**, Wilmington, CA, a producer of replacement parts for heavy duty diesel engines.

ICI Resins US, formerly **Polyvinyl Chemicals**, opened a plant in Frankfort, IN to produce water-borne polymers.

G.F. Goodman & Son opened a west coast sales office in Ventura, CA for its line of equipment.

PPG Industries broke ground for a fiber glass reinforcement evaluation center adjacent to its fiber glass manufacturing plant in Shelby, NC.

A group of local investors purchased the assets of **Re-**

flexion Industries, West Memphis, AK, a manufacturer of truck bumpers for pick-up trucks.

Arthur D. Little, Inc. opened a center for product development at its Cambridge, MA facilities.

Akzo Chemicals opened a Polyurethane Development Center at its research center in McCook, IL.

Allied-Signal started up a pilot plant to produce HCFC-141b for evaluation by customers as a replacement for CFC-11 blowing agent in urethane foams at its Buffalo, NY laboratory.

Contracts, licenses

Union Carbide and **General Electric** agreed to combine silicone businesses into a joint venture company. **GE-Carbide Silicones** will be headquartered in Waterford, NY. Union Carbide produces organofunctional silanes, specialty fluids and surfactant copolymers and GE Silicones manufactures heat cured rubber, RTV elastomers and resin systems. GE Silicones' manufacturing facilities are in Waterford, Toronto, Canada and Bergen op Zoom, The Netherlands. Union Carbide's silicone manufacturing facilities are in Tarrytown, NY, Sistersville and Versoix, Switzerland. Prior to the merger, GE Silicones formed a joint venture with **Oriental Chemical Industry Co.**, Seoul, South Korea and **Toshiba Silicone Co.**, Tokyo, Japan. **Don-**

RMA tire report through February
(figures in thousands of units)

Passenger tires	YTD '88	YTD '87	% change
Shipments			
original equipment	8,375	9,727	-13.9
radial	7,128	8,218	-13.3
replacement	21,437	20,494	4.6
radial	20,002	18,153	10.2
export	1,671	867	92.7
radial	1,474	739	99.3
total	31,483	31,088	1.3
radial	28,603	27,110	5.5
Production	29,279	27,836	5.2
radial	26,421	24,121	9.5
Truck & bus tires			
Shipments			
original equipment	1,403	1,248	12.5
radial	1,024	880	16.3
replacement	4,867	4,801	1.4
radial	2,868	2,476	15.8
export	513	280	83.2
radial	389	199	96.1
total	6,783	6,328	7.2
radial	4,281	3,555	20.4
Production	6,093	5,636	8.1
radial	3,650	3,022	20.8

Business Briefs

BFGoodrich had first quarter net income of \$34.7 million on sales of \$588 million.

British Petroleum reported first quarter profit of \$705 million on revenues of \$1.09 billion.

Carlisle Companies had first quarter net earnings of \$4.9 million on sales of \$139 million.

Continental AG reported 1987 net income of DM 55.8 million with group sales of DM 5.09 billion. The

sales from its General Tire subsidiary were not included in the figures.

Cooper Tire & Rubber announced earnings for the first quarter of \$6.8 million on sales of \$161 million.

Essex Chemical reported first quarter net income of \$2.1 million on sales of \$62.4 million.

Goodyear's net income for the first quarter was \$95.3 million on sales of \$2.6 billion.

M.A. Hanna Co. reported first quarter net income of \$13.1 million on sales of \$240.1 million.

Lubrizol announced first quarter net income was \$23.7 million on sales of \$295.9 million.

Lydall, Inc. reported first quarter earnings of \$1.6 million on sales of \$37.5 million.

NL Industries had a first quarter net income of \$35.1 million on sales of \$363.5 million.

Park-Ohio Industries reported a first quarter net loss of \$626,000 with sales of \$30 million.

Parker Hannifin reported third quarter net income of \$27.5 million on sales of \$574 million.

PPG Industries had first quarter net earnings of \$118.6 million on sales of \$1.373 billion.

The Standard Products Co. had a third quarter net income of \$10.3 million on sales of \$133.5 million.

Union Camp reported first quarter net income of \$67.5 million on sales of \$645.3 million.

RMA rubber report through February (figures in metric tons)

	YTD 1988	YTD 1987	% change
Total new rubber			
New rubber available	568,396	554,858	2.4
Imports	202,316	190,277	6.3
Exports	90,894	77,011	18.0
Apparent consumption	469,371	464,233	-1.1
Total natural rubber			
Imports	152,793	144,070	6.1
Exports	6,815	6,884	-1.0
Apparent consumption	144,041	135,318	8.3
Total synthetic rubber			
Production	366,080	366,581	-1
Imports	49,523	46,207	7.2
Exports	84,079	70,127	19.9
Apparent consumption	325,339	329,913	-1.1
Total SBR			
Production	145,528	139,168	4.6
Imports	13,824	13,944	-9
Exports	30,826	26,543	16.1
Apparent consumption	121,752	126,126	-3.5
Total nitrile			
Production	10,693	11,395	-6.2
Imports	3,217	2,058	56.3
Exports	2,630	1,770	48.6
Apparent consumption	12,086	10,643	13.5
Polybutadiene			
Production	65,065	61,270	6.2
Imports	12,772	14,049	-9.1
Exports	12,542	10,922	14.6
Apparent consumption	61,442	62,110	-1.1
Ethylene-propylene			
Production	40,840	44,174	-7.6
Imports	637	888	-1
Exports	9,429	7,500	25.7
Apparent consumption	35,045	33,054	6.0
Butyl, polychloroprene, polyisoprene, silicone and other synthetic elas- tomers			
Production	103,954	108,573	-4.3
Imports	18,823	15,268	23.3
Exports	28,652	23,392	22.5
Apparent consumption	95,013	96,980	-2.0

Markets, news

The Reagan administration concluded that funds already provided for the International Natural Rubber Organization to support our buffer stock obligations under the INRA I can remain available to support INRA II obligations. The Senate is expected to ratify the treaty.

Correction

Valley Rubber Mixing's listing was omitted from the 1988 Blue Book. The listing should have read:

Valley Rubber Mixing

1872 Akron-Peninsula Road
Akron, OH 44313
(216) 928-2048

James A. Beresford, president

Jack L. Reilly, vice president

mixing capabilities: all polymers, all colors, most blacks.

mixing: open mill, high intensity mixer to 1,000 lb. batch size.

tech service: yes

recipe development: yes

Valley Rubber Mixing also has a complete line of rubber chemical dispersions under the Val-Mix tradename.

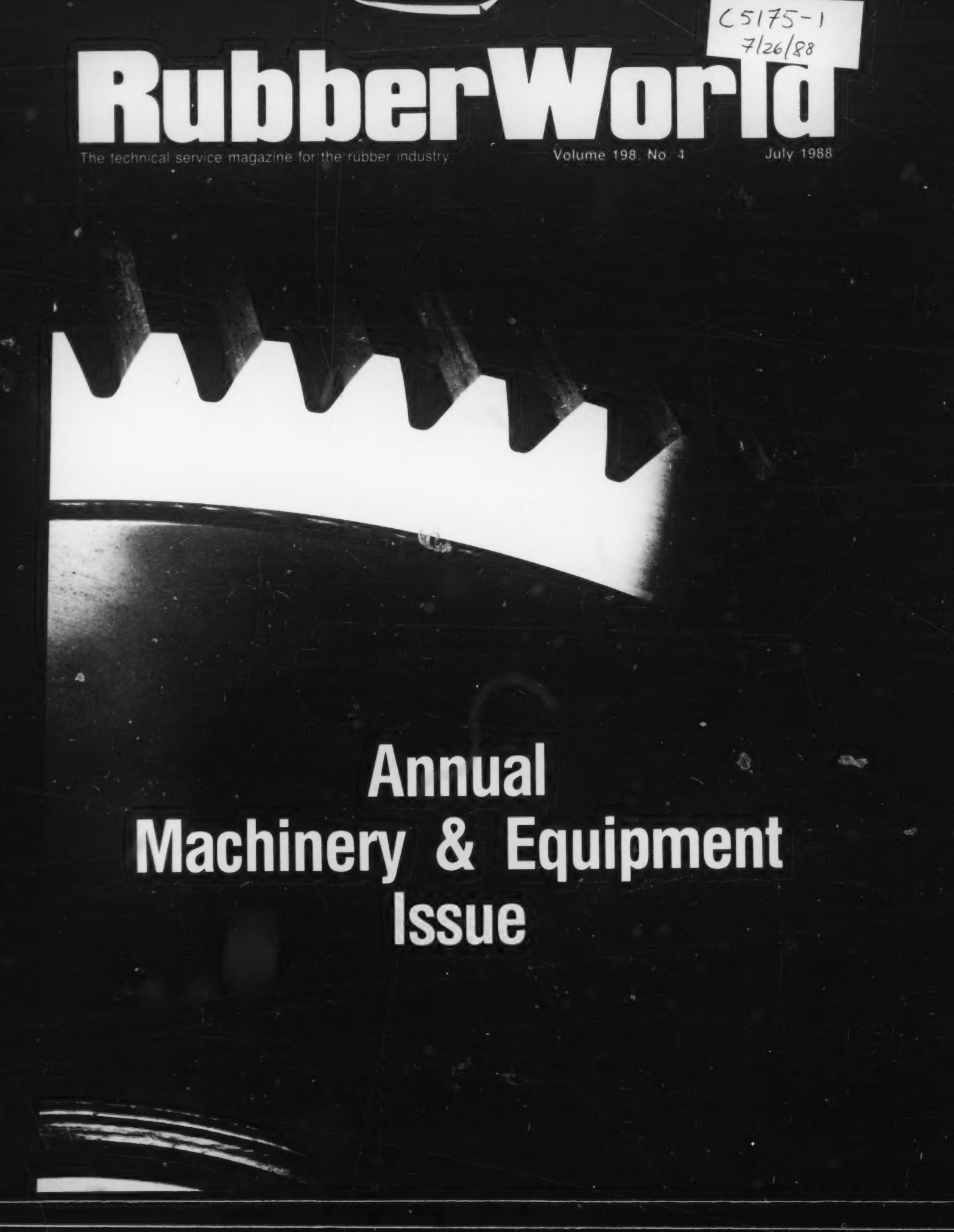
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RubberWorld

The technical service magazine for the rubber industry

Volume 198, No. 4

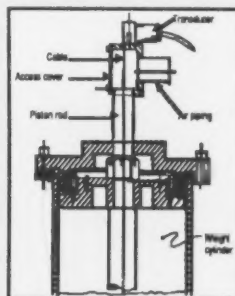
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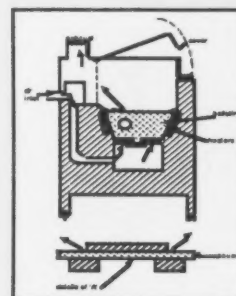
Annual Machinery & Equipment Issue



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Equipment '88



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A review of the upcoming SPI meeting, to be held in Philadelphia from October 18-21, is presented, including a listing of papers to be presented at a special chlorofluorocarbons panel.
- 12 Tech Service: Old hat?**
by Jon Menough, contributing technical services editor. This month's column looks at styrene butadiene rubbers, including their potential properties and applications.
- 14 The acquisition and application of data obtained during the mixing cycle of an internal batch mixer**
by William F. Flaherty, Farrel Corp. This article describes a unique data acquisition system refined to the special requirements of a banbury.
- 20 Continuous vulcanization processes**
by Dr. Elisabeth Herlaut, France Elastomers. The author puts in perspective the salient features of a microwave system for continuous vulcanization.
- 23 Use of fluidizing techniques in pneumatic handling of process materials**
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- 27 Characterization of natural rubber for greater consistency**
by Sekaran Nair, Rubber Research Institute of Malaysia. This article addresses the means available to producers of natural rubber to keep under good control the essential parameters and various components of natural rubber.
- 39 Used and rebuilt machinery suppliers**
Results of a survey of rebuilt rubber processing equipment suppliers are presented, along with a directory and a grid showing rebuilding capabilities.
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Cover

Cover photo courtesy of Horsburgh & Scott.

A Lippincott & Peto Publication

Editorial

Requests for back issues of a magazine are routine procedures providing the magazine was printed within the last five years. An issue that is more than 10 years old is out of the question. You can get it on microfilm, or as in most requests of this nature, we provide copies of the article(s) of your interest. Some requests pique your interest as to why someone would want an issue or article that is over 20 years old. Usually the intent can be rationalized, but a recent request we received is a lot harder to figure out. A foreign university has asked us for a microfilm copy of all our issues, with the exception of the last six years. This makes it the top order for sheer number at 1,128 issues requested and sets the record for most years back at 99. A question of how we are going to fill this order was brought up with the usual why do they want something so old?

In October of 1989, *Rubber World Magazine* will be celebrating its 100th anniversary. In conjunction with this event we will publish a special issue of our 100 years of publishing which has had the editorial staff looking through the past volumes. There is a lot of nostalgia, but not much relevant technology. At least not for today's manufacturers. That first issue of *The India Rubber World and Electrical Trades Review* contained a similar editorial mix as the present day *Rubber World*. There were technical articles on processing, news of the industry, information on new products, materials and machinery, and literature reviews. But the information contained is not going to help you make a better rubber product today. There isn't much resemblance between a rubber manufacturing plant from 1889 and one from 1988. Just like there won't be much resemblance between present day operations and the factories of the 21st century. The changes that have occurred in this decade alone make much of the technology developed during the rest of the 20th century outdated.

The evolution of technology is not abating; if anything it is accelerating. Not all new technology is applicable to the rubber industry, but it's going to take some keen minds to figure out what is a waste of time and what is a real benefit to your manufacturing operations. For those who have computerized segments of your operations, you know how often updates of your software are developed. You also know that others have developed similar software that does the process differently, which may be better and which may or may not be compatible with your present hardware. So you spend a good portion of time evaluating new systems to manufacture a product you've made for years, even when you think your system is running at optimum cost and efficiency. Because if you don't, there exists the potential for lost market share or even markets.

Just as you have to stay abreast of the new materials you have to be cognizant of the new manufacturing technologies. Computer integrated manufacturing and computer aided manufacturing are just two that you should be familiar with. Because they are the hot technologies presently, and will soon evolve into something else. And if you don't know the basics, getting to the next step will be more difficult.

Don R. Smith
Editor

RubberWorld

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Business Briefs

the plant. Its partner is China Petrochemical Development Corp.

Natrium Products, Cortland, NY plans to have a 15,000 tons per year sodium bicarbonate plant begin operation this fall.

Precision Rubber, Lebanon, TN has opened up service centers in NY, OH, MI, IL, TX, PA and CA for its injection and compression molded rubber products.

RMA rubber report through March (figures in metric tons)

	YTD 1988	YTD 1987	% change
Total new rubber			
New rubber available	883,989	855,143	3.4
Imports	316,710	297,001	6.6
Exports	141,679	120,147	17.9
Apparent consumption	740,058	728,311	1.6
Total natural rubber			
Imports	239,821	226,662	5.8
Exports	10,363	9,429	9.9
Apparent consumption	232,095	216,613	7.2
Total synthetic rubber			
Production	567,279	560,142	1.6
Imports	76,889	70,339	9.3
Exports	131,316	110,718	18.6
Apparent consumption	507,960	511,695	-7
Total SBR			
Production	226,114	216,090	4.6
Imports	22,904	20,977	9.2
Exports	47,044	44,201	6.4
Apparent consumption	190,342	196,505	-3.1
Total nitrile			
Production	18,493	18,071	2.3
Imports	4,300	3,310	29.9
Exports	4,185	2,906	44.0
Apparent consumption	19,331	16,497	17.2
Polybutadiene			
Production	98,248	94,796	3.6
Imports	20,167	23,114	-12.8
Exports	18,832	15,467	21.8
Apparent consumption	99,958	100,426	-5
Ethylene-propylene			
Production	64,491	66,004	-2.3
Imports	1,730	1,544	12.1
Exports	14,799	11,724	26.2
Apparent consumption	54,689	51,901	5.4
Butyl, polychloroprene, polyisoprene, silicone and other synthetic elas- tomers			
Production	159,932	163,180	-2.0
Imports	27,788	21,394	29.9
Exports	46,456	36,420	27.6
Apparent consumption	143,649	146,366	-1.9

Contracts, licenses

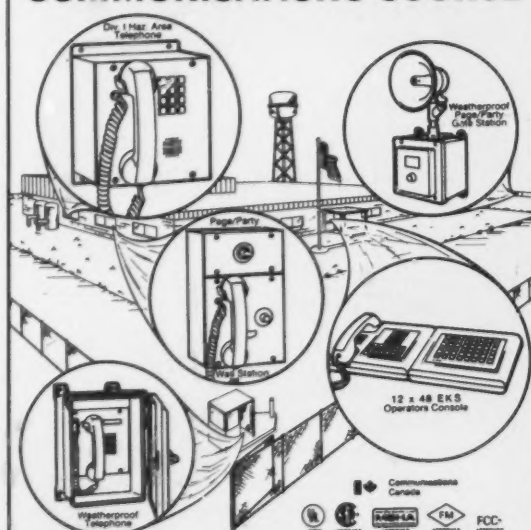
Dow Chemical and Exxon Chemical have formed a joint venture for the supply and marketing of styrenic thermoplastic elastomers. Engineering work is underway and equipment ordered for the first plant to be located at Dow's Plaquemine, LA site. It is scheduled to be on stream in 1990 and will produce 70 million pounds per year of high-quality styrenic TPEs. Dow is currently doing process/product development work on a large pilot plant. The initial thrust for the product will be in the adhesives and sealants markets.

Dexter Plastics reached an agreement to license its know-how, technology and patents exclusively to Asahi Chemical, Tokyo, Japan. Asahi will import Dexter's Dexflex and Ontex thermoplastic polyolefin products into Japan.

Akron Chemical has been added as a national distributor of J.M. Huber carbon blacks.

Goodyear Roofing Systems signed a marketing agreement with Dow Chemical to jointly promote and sell Styrofoam brand roofing insulation in conjunction with its roofing systems. Goodyear's Industrial Products division signed IBT Inc., Merriam, KS as a distributor for

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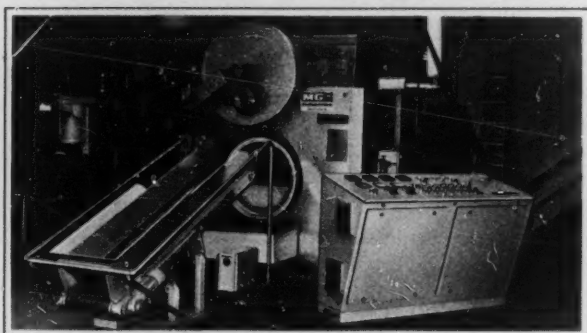
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Business Briefs

its products.

Monsanto named Lawson-Hemphill, Inc. of Rhode Island as representative for selling the company's tensile testers to the textile industry.

Exxon Chemical has taken a 15% stake in Kumho E.P. Rubber, a Korean joint venture with Korea Kumho Petrochemical who has 50% and Japan Synthetic Rubber, a 35% shareholder. KEPR plans to expand production capacity of ethylene-propylene rubber to 20,000 tons annually during 1989.

American Cyanamid and Pilot Chemical entered into a joint agreement to manufacture and market dodecyl diphenyl disulfonate, a specialty surfactant for the emulsion polymerization industry. Pilot is the manufacturer and Cyanamid will be the exclusive distributor with an option to license the manufacturing process technology.

BASF of West Germany and Hanyang Chemical Corp. of Korea plan a joint venture to manufacture MDI, aniline, polyurethane systems and other materials at a plant to be built in Yeochum, South Korea.

The machinery group of Mobay will manufacture electronically controlled, high pressure piston-dispensing equipment that is based on a design manufactured by Maschinenfabrik Hennecke GmbH. The equipment makes possible processing of highly filled polyurethane and polyurea systems with high viscosity and abrasiveness.

RMA tire report through February (figures in thousands of units)

Passenger tires	YTD '88	YTD '87	% change
Shipments			
original equipment	13,312	15,048	-11.5
radial	11,337	12,739	-11.0
replacement	34,183	31,964	6.9
radial	31,859	28,325	12.5
export	2,625	1,285	104.3
radial	2,307	1,106	108.6
total	50,121	48,297	3.8
radial	45,503	42,170	7.9
Production			
radial	40,732	36,881	10.4
Truck & bus tires			
Shipments			
original equipment	2,219	1,946	14.0
radial	1,626	1,371	18.6
replacement	7,868	7,466	5.4
radial	4,552	3,874	17.5
export	867	447	94.0
radial	683	317	115.5
total	10,954	9,858	11.1
radial	6,861	5,562	23.4
Production			
radial	5,709	4,599	24.1

Urethane Forum

CFC substitution will be examined at SPI polyurethane division meeting in Philadelphia

A special panel on chlorofluorocarbons, along with several technical papers devoted to CFCs, are some of the highlights of the upcoming Polyurethanes 88 meeting in Philadelphia. Sponsored by the polyurethane division of the SPI, the meeting will run from October 18-21 at the Wyndham Franklin Plaza Hotel.

The CFC panel, featuring a discussion on "Surviving the CFC crunch: An update on regulations, substitutes and alternatives," is one of six being offered at the meeting. The others include three end-market panels on furniture and bedding, automotive and construction; one on recycling and one on the economic outlook for the polyurethane industry.

Polyurethane 88 also marks the debut of business workshops, led by experts, and will cover crisis management; laws and regulations affecting the industry; chemical wastes and drum disposal; workplace safety; quality; and telemarketing. Morning sessions to address career and personal interests, including "career plateauing" and dual career relationships are also included.

In a press conference for the meeting, Robin Grieve of Dow Chemical and chairman of the management committee of the polyurethane division said "While we have seen sustained growth in all segments of urethane technology, we recognize that we are facing some critical issues, not least of which is the ozone depletion problem."

Grieve said the division recognizes the problem caused by CFCs and supports the ordered phase out of the use of fully halogenated CFCs called for in the Montreal Protocol. He said the polyurethane industry would move as fast as practical to meet the goals of the accord but a practical timetable must be developed in terms of using acceptable substitutes.

"Good sense dictates that screening of potential substitute products must be done first; concurrently, toxicity and safety testing must be evaluated. With this knowledge, manufacturers of CFCs can then proceed with the development and construction of manufacturing facilities to make the new products," Grieve said.

Some of the technical presentations that will be given covering CFCs are:

- ICI Polyurethanes will discuss partial blowing of rigid PIR/PUR boardstock with water in combination with CFCs.

- BASF and Dow Chemical will present papers discussing flexible foam without the use of CFCs as a blowing agent and combinations with other blowing agents.

- Allied-Signal will discuss the use of carbon absorption to recover CFC from industrial emissions.

- ICI will present a paper reviewing alternative blowing agents in spray foam.

- Du Pont will review their R&D programs on alternative

CFCs for polyurethane foams.

- Mobay will review the use of HCFC-123 and HCFC-141B in PUR/PIR rigid foam laminate insulation.

- BASF will also review their work on various chlorofluorocarbons in rigid foams.

These presentations are included in the 60 plus technical papers scheduled. The remainder will cover RIM, structural RIM, flexible foam and rigid foam.

At the same press conference, Dr. Peter Manno of Dow Chemical and the chairman of the product subcommittee on resin statistics, said the U.S. polyurethane industry was in good shape. "If we use the three principal polyurethane raw materials (TDI, MDI and polyether polyol) as barometers, we have been in a strong upward cycle. Total sales of TDI exceeded 700 million pounds and MDI reached 815 million pounds in 1987. At the same time sales of polyether polyols for polyurethanes passed 1.6 billion pounds."

He said the domestic demand for the three materials posted double digit increases for the first quarter of this year. Manno indicated that TDI production, which was 98% of capacity in 1987, will continue to be constrained this year despite a 6% increase in capacity. Some debottlenecking should increase MDI capacity about 3%, but it is unlikely that the capacity utilization will drop below last year's 93% level, he indicated. There are about 2.4 billion pounds of polyether polyol capacity in the U.S. and the 1987 production level was 68%. Manno said a double digit increase in 1988 can be expected over 1987 levels.

Trends in production/sales of U.S. polyurethane chemicals (percent)

	1986/85	1987/86	1Q 1988/ 1Q87
TDI			
production	4.0	7.8	6.7
domestic sales	-0.3	10.9	10.6
export sales	21.0	-3.9	42.5
MDI			
production	1.3	19.7	15.0
domestic sales	6.1	12.1	16.8
export sales	-2.5	40.4	53.0
Polyether polyols			
production	4.4	12.0	19.7
domestic sales	-0.3	7.2	11.6
export sales	41.6	64.2	113.5

Supplies tight for some machinery, but rebuilders see increased sales

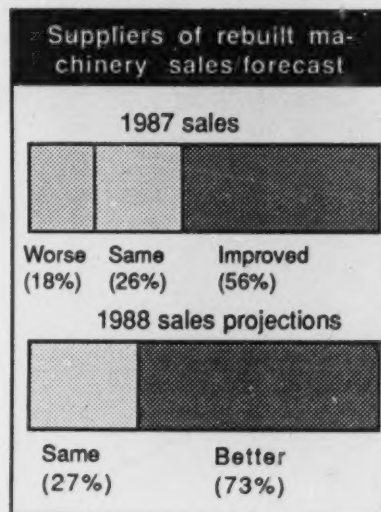
Although supplies are tight for rebuilt rubber machinery, most dealers reported improved sales in 1987 and forecast increases for 1988. *Rubber World's* annual survey of used and rebuilt machinery suppliers shows that 55% of the dealers posted higher sales in 1987 over 1986 and that 63% are projecting 1988 sales to be better than 1987.

Of the 34 used and rebuilt rubber machinery suppliers surveyed, (see directory beginning on page 40) 29 responded to the survey. Six dealers indicated that sales were worse in 1987, while three said business was the same as 1986. For 1988, none of the respondents predicted lower sales, while five said they should do about the same as 1987. Two companies that participated in prior surveys curtailed operations. Chatham Gear Works of Medina, OH ceased operations while Nerpc, Inc., New Haven, CT, closed its manufacturing operations. Chatham supplied gears for mills, calenders and banburies. Nerpc supplied rubber production machinery.

Extruders, especially cold feed extruders, are in the greatest demand and the machines that are hardest to locate according to many of the dealers. Presses are also in demand but most of the dealers indicated they didn't have much problem filling these orders. However, some indicated they were having trouble finding good injection

molding machines. Some of the respondents said they are getting requests for larger, more sophisticated machinery systems than in the past.

Demand for rebuilt mills and mixers

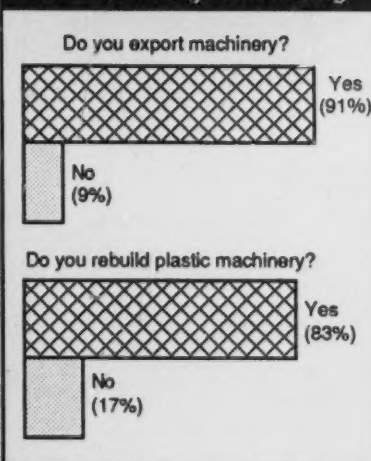


has remained strong and many in the survey said customers were looking for lab and testing equipment. Rebuilt plastic processing machines are also being asked for and 83% of the respondents said they sell this equipment.

Besides cold feed extruders and injection molding presses, many dealers indicated it was difficult to locate large 4-roll calenders, braiding machines, lab equipment and rheometers. In general, good used machinery suitable for rebuilding seems to be in tight supply according to the survey.

Only two of the respondents said that they did no exporting of machinery. Akron Tire Engineering and Machinery owner Eric Dorfner said that 99% of his business was exported. Alkar Inc., Kent, OH said they export 45% of their equipment, and most of the others said foreign sales accounted from 10-25% of their business.

Export of machinery & plastic machinery rebuilding



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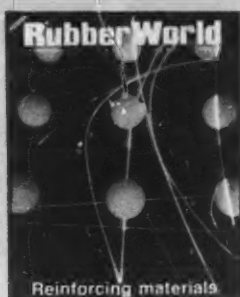
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Volume 198 No. 5

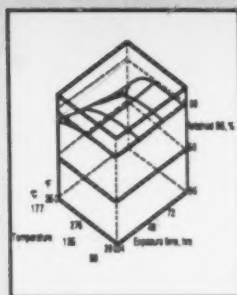
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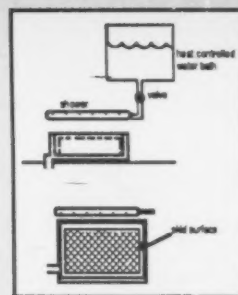
Reinforcing materials



Reinforcing materials



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- 20 Elastomer reinforcement with short Kevlar aramid fiber for wear applications**
by *Keith R. Watson and Arnold Frances*, Du Pont. This article discusses the advantages in properties possible with a new class of engineering materials created by the reinforcement of rubber with short aramid fibers.
- 25 A light, low cost, carbon filler**
by *William P. Hettinger, Jr., Richard P. Krock and D. Chris Boyer*, Ashland Oil, Inc. The authors discuss the advantages and difficulties of appropriately dispersing short carbon fibers into rubber compounds.
- 30 The relation between temperature dependence of viscoelasticity and friction due to hysteresis**
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Cover photo courtesy of Ausimont. Photographed by Michael Weymouth.

A Lippincott & Peto Publication

Editorial

The U.S. political season is upon us, and this being a presidential election year, you will be informed on what you are really concerned about. Special interest groups will reveal poll after poll indicating the "mood" of the citizenry trying to somehow influence the next person to occupy 1600 Pennsylvania Ave. The candidates usually avoid getting specific on any issue. They usually have a plan of some sort. Recently we have had plans to end the Vietnam conflict, bring hostages home and return America to greatness. This year's plan will have to deal with the budget, and this is where most of the citizens cringe. When politicians start talking about money, you can bet they're after more of yours. And it seems this time around, there are all kinds of plans.

The one that bothers us the most is called the gasoline tax. It's not to be confused with the one passed in 1983 that more than doubled the tax from four to nine cents a gallon, or the ones prior. Those taxes benefitted the people using the gasoline as it was used for road construction and repair. This new tax has an altogether different purpose. It will be used to reduce the federal deficit. And they're not talking about a nickel increase this time. Some think it should rise from the present nine cents to at least \$1 per gallon. The rationale being that prices for gasoline in the U.S. are relatively cheap and an increase in price would be "painless," as one advocate wrote in the *New York Times*. The reason its cheap is because during the oil crisis during the 1970s we didn't like the high prices and set about cutting consumption. Motorists started driving smaller cars, cars traveled farther distances on a gallon of gas, businesses became energy efficient and developed more efficient processes. For a reward, we're asked to cut the federal deficit through a "painless" tax.

This painless tax would hurt the rubber industry. There is no need to explain the relationship between a healthy rubber industry and the number of miles driven. There is no need for the rubber industry to bear more of the burden of the deficit since it has had very little to do with creating it. Just as the oil import fee that was trotted out a while ago was deemed a bad tax, taxes on gasoline that aren't used to improve driving conditions are worse. Not only would the 85% of all workers who commute in private motor vehicles see their paychecks erode, they would be paying more for the goods they purchase when business passes along its extra fuel costs. The rubber industry would suffer extra because it depends on a driving public for the sale of many of its products. But this form of taxation is popular because it can put a dent in the deficit and is perceived to be "painless" by some. It is anything but painless and should be dropped like the oil import tax before it. Hopefully there will be a poll showing the ugly mood of the citizenry toward this scheme and the politicians won't buy this painless assertion.

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RubberWorld

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Business Briefs

Acquisitions, expansions

Polysar will spend BF 635 million (US \$18.5 million) to increase capacity for halogenated butyl rubbers at its Antwerp, Belgium plant. Capacity figures were not released. Construction is expected to be completed during the first quarter of 1990.

BFGoodrich announced the full start-up of its epichlorohydrin plant in Hattiesburg, MI. The plant was shut down at the end of 1987 for expansion and modernization. BFG will consolidate the production of Hydrin and Herclor product lines at the plant. BFG is also consolidating the polymer production of its Avon Lake, OH plant with Hattiesburg which will enable the Avon Lake plant to produce other new products.

Goodyear is building a 16 million pound powdered nitrile rubber unit at its chemical plant in Houston, TX. The \$6 million investment will provide a domestic source since the company imports powdered nitrile rubber from its chemical subsidiary in LeHavre, France.

Goodyear's \$6 million investment in renovating and modernizing an industrial automotive hose and v-belt plant in San Luis Potosi, Mexico has been realized as full production commenced. Goodyear purchased the 64,000 sq. ft. plant from Goodall Rubber last year.

Goodyear broke ground for its \$320-million radial tire plant in Napanee, Ontario. Work on the 51,200 square me-

ter facility has begun with start-up of production scheduled for early 1990.

Monsanto established an Instruments Service Center at Ta Chung Hua rubber factory in Shanghai. **China Jinshan Associated Trading Corp.** will operate the center that will provide training and support for the various Monsanto instruments throughout the country.

Imperial Adhesives acquired **IPI Adhesives**, Opelika, AL. and the adhesive division of **International Shoe Co.** Imperial acquired the customer lists, processing equipment, formulas and related technology from both companies.

Ansell International acquired the **Granet Division** of **WGM Safety Corp.**, Framingham, MA. Included in the sale was Granet's 80,000 sq. ft. glove manufacturing plant and distribution center in Snow Hill, NC.

Linde AG, West Germany, will acquire the stock of **Scientific Design Co.**, Little Ferry, NJ, a subsidiary of **Mobay Synthetics Corp.** Included in the sale are the worldwide licensing and engineering businesses of SD and their facilities for the manufacturing of catalysts for ethylene oxide, maleic anhydride and other products. In addition, the sales and licensing of butane-based maleic anhydride catalysts developed by Mobay Synthetics (formerly **Denka Chemical**) are part of the transaction. Terms of the agreement were not disclosed.

Du Pont is now offering services of its Engineering Test Center to the industrial community. The ETC is a fully equipped testing facility specializing in thermal analysis, particle characterization and phase equilibrium.

Silcofab, Guelph, Ontario has acquired **Taylor Molding Systems**, Fairport Harbor, OH. TMS has patented and proprietary equipment and process technology related to the manufacturing of precision elastomeric components.

Parker Hannifin completed its acquisition of **Stratoflex, Inc.**, Fort Worth, TX., a manufacturer of hoses and fittings.

Ames Rubber Corp., Hamburg, NJ has completed a financial restructure and issue of \$5 million of tax-exempt bonds. The bonds will be used to renovate existing plant buildings in Vernon Township and for the acquisition of machinery and equipment to be used in its manufacturing facilities.

Ethyl Corp. is relocating its **Imi-Tech Corp.** plant in Magnolia, AK. The wholly owned subsidiary produces Solimide foam insulation and the new plant doubles production capacity.

Amoco Performance Products will consolidate its research and development activities at a new suburban Atlanta location. Construction of the 235,000 sq. ft. facility is to be completed by August 1990.

Unichema Chemicals opened a regional sales office in Manalapan, NJ to handle all products produced at its Chicago facility including glycerines, fatty acids and derivatives.

RMA tire report through May
(figures in thousands of units)

Passenger tires	YTD '88	YTD '87	% change
Shipments			
original equipment	23,332	24,434	-4.5
radial	19,848	20,650	-3.9
replacement	58,971	56,377	4.6
radial	54,946	49,985	9.9
export	4,121	3,181	88.9
radial	3,599	1,892	90.2
total	86,424	82,992	4.1
radial	78,394	72,527	8.1
Production			
radial	74,207	70,009	6.0
	67,017	60,834	10.2
Truck & bus tires			
Shipments			
original equipment	3,822	3,367	13.5
radial	2,806	2,368	18.5
replacement	13,133	13,026	0.8
radial	7,597	6,850	10.9
export	1,435	772	85.8
radial	1,122	537	108.9
total	18,390	17,165	7.1
radial	11,525	9,755	18.1
Production			
radial	15,514	14,857	4.4
	9,411	8,425	11.7

Business Briefs

A group of **Koppers** executives along with **The Sterling Group** as a financial partner, will purchase for \$660 million the assets of **Kopper Chemical and Allied Products** business from **Koppers** which was acquired in June by **Beazer PLC**.

Du Pont will increase worldwide capacity for "Teflon" fluorocarbon resin by 30% over the next five years. **Du Pont** manufactures fluorocarbon resin at **Parkersburg, WV**, in the Netherlands and through a joint venture with **Mitsui Petrochemical** in Japan.

Cookson America, Providence, RI purchased 50% interest in **Heubach, Inc.**, Newark, NJ a manufacturer of specialty color pigments.

Exxon Chemical has initiated design and engineering for a propylene plant at its **Notre-Dame-de-Gravenchon** site in France. **Exxon** has begun market development activities based on product imported from the U.S.

General Polymers, a division of **Ashland Chemical**, will open a distribution facility in Toronto to serve the Canadian market.

Cos-Mar Co., a styrene monomer joint venture between **Fina Oil & Chemical** and **Borg-Warner Petrochemicals** will debottleneck its **Carville, LA** styrene facility by 400 million pounds annually.

Borg-Warner will increase liquid and solid phosphite production by 2.5 million pounds at its **Morgantown, WV** plant.

ARCO Chemical is constructing a 75 million lbs./yr. butanediol and derivatives facility at its **Channelview, TX** complex. The company has also initiated engineering studies and feedstock procurement activities for a worldwide propylene oxide plant to be constructed on the U.S. Gulf Coast.

ARCO is also involved in construction of the first propylene oxide/styrene monomer plant to be built in Korea. **Yukong ARCO Chemical**, a joint venture of **Yukong Ltd.** and **ARCO** is building the plant in **Ulsan** scheduled to start-up in the first quarter of 1990. Plant capacity will be 100,000 metric tons of PO and 225,000 tons of SM.

ICI Fibres, Harrogate, England, is investing £5 million in technology to produce heavy-decutex nylon 6.6 yarn at the company's **Doncaster Works**. Production is due to come on-stream in mid-1989 and will be aimed at the rubber reinforcement industry, primarily tires and conveyor belting.

Contracts, licenses

Exxon Chemical and **Japan Synthetic Rubber** signed a joint technology agreement covering ethylene-propylene rubber. Both parties will jointly develop new process technology with the objective of providing products with property advantages over those currently available. **Exxon** and **JSR** will consider establishing an EP manufacturing company in Japan to commercialize the technology. The parties have also established an EP supply arrange-

ment. **Exxon** will produce several **JSR EP** rubber grades in its plants for **JSR** sales in the U.S. market and **JSR** will produce **Exxon EP** rubbers in its plant for **Exxon** sales in the Asia Pacific region.

Exxon and **Chevron Chemical** will jointly create an ethylene import system in the **Houston** area comprising a new terminal, pipeline connections and other facilities related to storage, quality control and distribution.

RMA rubber report through March (figures in metric tons)

	YTD 1988	YTD 1987	% change
Total new rubber			
New rubber available	1,169,257	1,122,637	4.2
Imports	408,261	390,422	4.6
Exports	193,405	163,388	18.4
Apparent consumption	962,362	950,966	1.2
Total natural rubber			
Imports	308,419	295,954	4.2
Exports	16,334	12,287	32.9
Apparent consumption	291,013	278,916	4.3
Total synthetic rubber			
Production	760,996	734,215	3.9
Imports	99,842	94,468	5.7
Exports	177,071	151,101	17.2
Apparent consumption	671,345	672,046	-1
Total SBR			
Production	305,427	284,958	7.2
Imports	29,349	28,004	4.8
Exports	64,711	58,503	10.6
Apparent consumption	254,394	260,808	-2.5
Total nitrile			
Production	24,348	23,675	2.9
Imports	5,044	4,586	10.0
Exports	5,567	4,158	33.9
Apparent consumption	23,991	22,493	6.7
Polybutadiene			
Production	131,597	124,780	5.3
Imports	27,334	30,043	-9.0
Exports	23,772	21,066	12.9
Apparent consumption	133,663	131,377	1.7
Ethylene-propylene			
Production	86,813	87,002	-2
Imports	2,796	2,203	26.9
Exports	19,233	15,933	10.7
Apparent consumption	74,096	68,514	8.2
Butyl, polychloroprene, polyisoprene, silicone and other synthetic elastomers			
Production	212,809	211,800	.5
Imports	35,319	29,632	19.2
Exports	63,788	51,436	24.0
Apparent consumption	185,199	188,856	-1.9

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The technical service magazine for the rubber industry

Volume 198 No. 6

September 1988

Non-CFC chemistry systems

**Roll cover design
considerations**

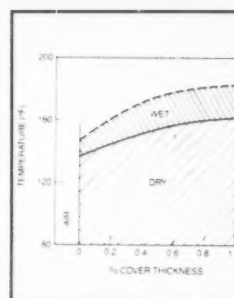
**Chemistry and application
of high resilience urethanes**



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Cavity transfer mix p. 8



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5 Business Briefs

Acquisitions, expansions; contracts, licenses; financial statements; markets, news.

8 Tech Service: CTM - Some new possibilities

by Jon Menough, contributing technical services editor. The use of a cavity transfer mixer for blending widely dissimilar materials, after being properly set up with extruders and associated equipment, is discussed in this month's column.

12 Urethane Forum

This month's column looks at a chemistry system for flexible polyurethane foam, introduced by Union Carbide, that can produce a wide variety of polyurethane foam grades without the use of chlorofluorocarbons.

14 Roll cover design considerations for polyurethanes

by Joseph F. Cheatham, Stowe Woodward Co. This article shows how to take advantage of the properties of polyurethanes for de-watering rolls in the paper industry.

22 Chemistry and applications of high resilience urethane elastomers

by Charles Demarest, Kryptonics, and Ralph Moore, consultant. The authors describe the fundamental properties, formulation and testing necessary to achieve highly resilient urethane elastomers, for example those needed in lift truck tires.

27 Microwave vulcanization for good, constant and reliable production results

by Peter Tedesko, Cim-Dor Corp., Cim-D'or S.A. The author describes the advantages of a microwave tunnel over the hot air tunnel for many production situations.

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edited by Bob Samples, Akron Rubber Development

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Cover

Cover photo courtesy of Leggett & Platt, Inc.

A Lippincott & Peto Publication

Editorial

When Thomas Midgley introduced chlorofluorocarbons it is said he inhaled a quantity and blew out a candle to illustrate the harmlessness and non-flammability of the chemical. And it was exactly what he said it was, and turned into the wonder chemical of the day. It was deemed completely safe because CFCs do not react with other substances or break down. But as technology moved on, the safeness of these chemicals, used considerably as blowing agents in polyurethane manufacturing, came into question and now there is no doubt CFCs cause serious harm to the environment of the whole planet. Their connection to the depletion of the earth's ozone layer has been confirmed and now there is talk that the recent Montreal Protocol isn't sufficient enough. That pact has CFC production frozen at 1986 levels with a 20% reduction to be enacted in 1993 and another 30% cut scheduled in 1998. The agreement takes force January 1, 1989, but there are already calls for speeding up some of the cutback dates. Newer data on ozone depletion shows that the agreement will not reduce depletion, only slow the growth. If the ozone is to be repaired back to pre CFC conditions a near total ban is called for.

This is definitely not good news to polyurethane processors. A reduction in CFC production was unheard of five years ago, now a total ban has been suggested. A few years ago the chance of a total ban was zero but the odds go up with every new report. It's safe to say the use of CFCs in polyurethane processing will see the same fate as CFC use in aerosol sprays.

What's encouraging from this is the reaction of the polyurethane industry. It has mobilized suppliers and processors through its technical groups and the suppliers of CFCs will pool technology. This year's Polyurethane World Congress made CFC substitution a top priority and the upcoming SPI Polyurethane 88 meeting will feature a special panel on the subject along with several papers on the latest developments in alternative technologies. (This month's Urethane Forum on page 12 discusses a new chemistry system). And recently, eight worldwide producers of CFCs announced they will pool resources to test HCFC-141b, currently under consideration to replace CFC-11. The HCFC has significantly reduced ozone depletion potential and by pooling resources the development time can be reduced from about six or seven years to five.

The alternatives will not be cheap. Cost estimates range from at least double to as much as four times as much as CFCs cost. However, it won't be a surprise. You know it's coming and can plan for it. Just as all industries should somehow be planning for other, similar restrictions. Ozone depletion is serious and serious solutions are being considered. Land, air and sea pollution is also serious, as is acid rain, and the greenhouse effect. Serious solutions could be legislated that will have a profound effect on the way you do business. Those that stay on top of things will have a step up on the competition. Those that don't may be headed for the same fate as CFCs.

Don R. Smith
Editor

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Business Briefs

BRISA Bridgestone Sabanci Tire Manufacturing has been formed through a joint venture between **Bridgestone** and **The Sabanci Group** of Turkey. Bridgestone is acquiring an equal 36% share of Sabanci's original 72% holdings in the tire operations of **LASSA Tire Manufacturing**. The joint venture will incorporate Bridgestone technology and will increase production of passenger radials, as well a new line-up of truck and bus products.

Mitsubishi Heavy Industries and **L & T McNeil Ltd.**, Madras, India concluded an agreement covering tire production machines. MHI provides manufacturing technology on a tire building machine, a bias cutter and a hydraulic passenger tire curing press. McNeil will assemble and manufacture these machines from MHI component parts and locally procured components.

R W Technology, Inc. licensed **American Typlax Systems**, Washington, PA its manufacturing technology, the process and formulations to recycle discarded tires and other rubber waste products and to produce a rubber/plastic blend called Typlax.

UCB and RTZ Chemicals have formed a company for the development, production and distribution of specialty chemicals used in radiation curable formulations. The new company will consist of a worldwide organization with operating subsidiaries in the U.S. and Europe, and licensees in the Far East.

P.T. Victory Long Age Indonesia, a joint venture between **Long Age Industrial** of Taiwan and an individual Indonesian investor will manufacture 1.5 million sport shoes yearly in Surabaya, East Java. Production is to begin in September, 1989.

Agra Products signed **M.C. Schroeder Co.**, Charlotte, NC as a sales representative for its processing system equipment.

Budzar Industries has added **Process Temperature Components**, Richmond, VA as a representative for its fluid heat transfer systems and industrial duty process cooling equipment.

Financial statements

American Biltrite reported second quarter net earnings of \$2.9 million on sales of \$39.7 million.

BASF Group reported pre-tax earnings of \$1 billion for the first half of 1988 on sales of \$12.7 billion.

Bemis Co. reported income for the second quarter of \$9.9 million on sales of \$275.8 million.

Blasius Industries reported a net loss for the year of \$4.2 million with sales of \$50.6 million.

BP America had a \$621 million operating profit for the second quarter on revenues of \$4.3 billion.

Bridgestone Corp. had pre tax earnings of \$258 million for the first half of 1988 on sales of \$2.19 billion.

Corcap Inc. reported a second quarter loss of \$1.2 mil-

lion with sales of \$9.7 million.

Essex Chemical reported net income for the second quarter was \$1.4 million on sales of \$76.7 million.

Lydall, Inc. had a second quarter net income of \$1.4 million on sales of \$28.5 million.

NL Industries reported second quarter net income was \$42.7 million on net sales of \$393.8 million.

Parker Hannifin reported net income for fiscal 1988

RMA rubber report through May (figures in metric tons)

	YTD 1988	YTD 1987	% change
Total new rubber			
New rubber available	1,462,287	1,394,358	4.9
Imports	495,887	482,347	2.8
Exports	241,660	208,433	15.9
Apparent consumption	1,204,020	1,176,667	2.3
Total natural rubber			
Imports	375,657	360,579	4.2
Exports	19,545	15,089	29.5
Apparent consumption	356,743	341,523	4.5
Total synthetic rubber			
Production	966,400	914,011	6.0
Imports	120,230	121,768	-1.3
Exports	222,115	193,344	14.9
Apparent consumption	847,272	835,140	1.5
Total SBR			
Production	384,232	354,769	8.6
Imports	36,549	35,942	1.7
Exports	81,977	74,224	10.5
Apparent consumption	323,126	322,101	.3
Total nitrile			
Production	32,598	29,710	9.7
Imports	6,985	5,785	20.7
Exports	6,994	5,497	27.2
Apparent consumption	31,925	27,856	14.6
Polybutadiene			
Production	170,060	154,653	10.0
Imports	33,350	37,501	-5.7
Exports	29,741	27,460	8.3
Apparent consumption	170,458	162,725	4.8
Ethylene-propylene			
Production	108,360	108,082	.3
Imports	4,317	2,604	65.8
Exports	24,184	20,233	19.5
Apparent consumption	92,012	84,977	8.3
Butyl, polychloroprene, polyisoprene, silicone and other synthetic elastomers			
Production	270,148	264,797	2.0
Imports	37,029	39,936	-7.3
Exports	79,219	65,930	20.2
Apparent consumption	229,749	237,483	-3.3

Business Briefs

was \$106.5 million on sales of \$2.25 billion.

Park-Ohio reported a second quarter net loss of \$528,000 with sales of \$33.3 million.

Smith & Nephew reported operating profit of £52.1 million on sales of £267.1 million for the first six months.

The Standard Products Co. reported fiscal 1988 net income of \$34.05 million on sales of \$508.33 million.

Sumitomo Chemicals reported first half operating income of \$170 million on sales of \$2.09 billion.

Markets, news

A report in a Canadian newspaper indicates that Uniroyal Goodrich may be close to selling one of its two tire plants in Kitchener, Ontario. Under consideration from Cooper Tire, Yokohama and Continental is the Kitchener South plant that was built in 1961 and produces about 12,000 passenger, light truck, truck, bus and off-road tires a day.

Inventor T.K. Seiberling of Akron, OH has been issued a U.S. patent for a tire retreading process that produces less expensive and lighter weight retread, uses less material and can be cured in less time than conventional methods. The process consists of partially curing the cushion gum layer used between the carcass and the tread and between the ends of the tread. The cushion gum layer is subjected to electron

radiation partial pre-cure, allowing the rubber to remain tacky on the surface for final assembly or bonding of the carcass and new tread. The invention reduces the time required to vulcanize the retread tire assembly and also reduces the gauge or thickness of the cushion gum layer, creating a less expensive, lighter weight, cooler running retread tire, according to the patent.

Due to sharply increasing costs of raw materials, labor, transportation and utilities, Goodyear's industrial products division has increased prices for its power transmission, conveyor belting and some industrial hose products. Prices were increased at a flat 6% for conveyor belting, and 4-6% for power transmission products. A price increase of 4-6% was also placed on all Spiraflex hose products.

List and off-list prices for most of Dow Corning's silicone products will be increased between 3-8%. Contract prices will be re-negotiated as soon as terms permit. Prices of silicone rubber compounds and silicone bases and gums were increased between 5-8% and general fluid, emulsion and sealant prices increased 3-8%. Increased raw material and higher operating costs were cited by the company for the increases.

RMA tire report through June
(figures in thousands of units)

Passenger tires	YTD '88	YTD '87	% change
Shipments			
original equipment	28,272	28,906	-2.2
radial	24,092	24,450	-1.5
replacement	73,932	71,080	4.0
radial	68,912	63,227	9.0
export	4,840	2,714	78.3
radial	4,234	2,346	80.5
total	107,043	102,700	4.2
radial	97,238	90,023	8.0
Production			
radial	89,090	83,718	6.4
radial	80,598	72,884	10.6

Truck & bus tires

Shipments			
original equipment	4,599	4,040	13.8
radial	3,379	2,818	19.9
replacement	16,227	16,306	-0.5
radial	9,383	8,622	8.8
export	1,708	941	81.6
radial	1,337	662	102.0
total	22,535	21,287	5.9
radial	14,098	12,101	16.5
Production			
radial	18,572	17,696	5.0
radial	11,276	10,032	12.4



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RubberWorld

The technical service magazine for the rubber industry

Volume 199, No. 1

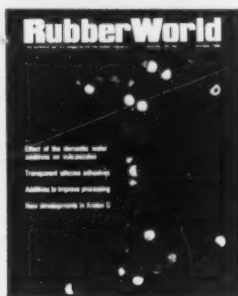
October 1988

Effect of the domestic water
additives on vulcanizates

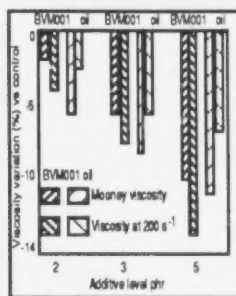
Transparent silicone adhesives

Additives to improve processing

New developments in Kraton G

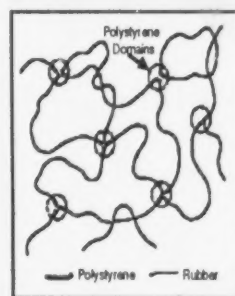


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Cover photo courtesy of The University of Akron Polymer Science Institute

A Lippincott & Peto Publication

Editorial

I have a couple of requests this month. Both require you being conscientious. The first deals with some feedback we would like to get from you. It concerns expanding the duties or changing the job description of the executive director for the Rubber Division of the American Chemical Society. This question comes up every so often and I would like to bring this debate out into the open. Other technical societies give much more responsibility to their directors, some don't have executive directors. I am asking you to write in and voice your opinion one way or the other.

The incorporation of the "Mini Expo" at this month's technical meeting in Cincinnati is a strong indication of the growth of the division in what has been a period of shakeouts, buyouts, takeovers, reorganizations and closings. To think of the growth the expositions have gone through since their inception and now off-year mini-expos with over 100 exhibitors belies the tag of mature that is placed with this industry. But, with all of this growth and change, the division's structure has stayed pretty much the same. Is this OK? Should the division reorganize like most of the members' companies have done? Write us.

The second request involves asking those responsible for their company's listings in various directories to please respond. We publish a number of directories throughout the course of the year. This means considerable time is spent collecting and verifying data, and listening to pleas for extensions. We are usually lenient on the tardy ones, we want the information. Extra forms, duplicate forms and questionnaires will be sent, just ask. Many do, some don't. Then after publication the calls come from those not included, or those with information that was incorrect, usually from not having their listing updated.

This request has another purpose. Our sister publication, *Automotive Polymers & Design* will be publishing a directory issue in December. A problem we're having is that the responses from the rubber parts manufacturers is not what it should be. Because we publish *Rubber World*, we know there are more original equipment rubber parts suppliers out there than have replied to our questionnaire. Granted our mailing list probably didn't include 100% of the companies in this segment of the industry, but it's close. If you're a rubber parts supplier to the original equipment automotive industry you should be in this issue. Mail back your questionnaire. If you didn't get one, please call our offices and we'll send you one immediately.

Don R. Smith
Editor

RubberWorld

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Business Briefs

Acquisitions, expansions

Du Pont said it was expanding production of dibasic ester and is modifying a plant that produces paraphenylene diisocyanate and trans 1, 4 cyclohexane diisocyanate. The DBE capacity increase will be made possible by a dibasic acid plant expansion presently under construction in Victoria, TX. The DBA increase is for 20 million pounds annually with more than 85% of that converted to DBE. The plant modification is scheduled for completion by year-end, with production of developmental quantities to begin the first quarter of next year. Commercial production is projected to begin by 1990.

Gates Rubber is investing \$17 million over the next three years on a new synchronous belt factory in Dumfries, Scotland. The new 100,000 sq. ft. building will house production, warehousing, development facilities and offices. Production is expected to begin during the summer of 1989. Gates also purchased **Spun Steel, Inc.**, Bloomfield Hills, MI, a manufacturer of pulleys, tensioners and accessory drive systems for the North American auto industry with plants in Dothan, AL and Strathroy and Windsor, Ontario, Canada.

Dow Chemical will pay \$366 million to acquire **Essex Chemical Corp.** after the Essex board of directors approved the deal. Essex manufactures adhesives and sealants primarily for the automotive industry and also makes generic drugs, industrial chemicals and organic intermediates.

Ausimont, Inc. will open a new technical service center near Morristown, NJ later this year. The facility will support its Dutral and Tecnoflon elastomer customers in North America.

Standard Products will open a 50,000 sq. ft. plant in Columbia, SC to manufacture moldings for automobile doors and windows. Production is scheduled to start in early 1989.

Goodyear dedicated a \$15.6 million composites technical center in Jackson, OH. The 21,000 sq. ft. addition to the company's automotive reinforced plastics plant will be used for development and manufacture of large exterior body panels for the transportation industry.

Shell Chemical has opened a Detroit polymers office to serve its automotive customers. The company consolidated the commercial marketing of its polymer compounds in the office which include its epoxy resins, polypropylene and thermoplastic elastomers. Shell is planning to add a laboratory dedicated to elastomer assistance.

Hoechst Celanese is building a \$9.4 million plant for the manufacture of liquid crystal polymers at its Shelby, NC site with start up scheduled for the middle of next year. The company said the \$13 million expansion of its compounding facilities at Shelby should come on stream in mid-1989 as well. The company also announced two expansions slated for its Bishop, TX acetal copolymer facility that will bring capacity to 170 million pounds annually.

Myers Industries acquired **Plastic Parts Inc.** of Shelbyville, KY, a manufacturer of custom-engineered structural foam components used in commercial, industrial and electronic parts.

Cyprus Minerals will acquire **Windsor Minerals**, the talc-producing subsidiary of **Johnson & Johnson**. Included in the sale are two mills, several mines and reserves in Vermont, and a talc mine and mill in California.

RMA rubber report through June (figures in metric tons)

	YTD 1988	YTD 1987	% chg.
Total new rubber			
New rubber available	1,747,361	1,650,686	5.9
Imports	583,599	563,710	3.5
Exports	297,982	251,200	18.6
Apparent consumption	1,430,777	1,390,756	2.9
Total natural rubber			
Imports	440,512	419,518	5.0
Exports	25,324	17,884	41.6
Apparent consumption	417,199	397,822	4.9
Total synthetic rubber			
Production	1,163,762	1,088,976	7.1
Imports	143,087	144,192	-8
Exports	272,658	233,316	16.9
Apparent consumption	1,013,573	992,929	2.1
Total SBR			
Production	458,818	421,932	9.0
Imports	44,418	41,289	7.6
Exports	100,359	89,439	12.2
Apparent consumption	386,362	379,506	1.8
Total nitrile			
Production	38,878	35,733	8.8
Imports	8,631	7,446	15.9
Exports	8,290	6,993	18.6
Apparent consumption	38,475	33,636	14.4
Polybutadiene			
Production	202,634	185,728	9.1
Imports	44,015	44,660	-1.4
Exports	33,664	32,772	2.7
Apparent consumption	206,827	196,095	5.5
Ethylene-propylene			
Production	130,673	129,062	1.3
Imports	6,272	3,035	106.7
Exports	29,168	23,881	22.1
Apparent consumption	112,851	102,196	10.4
Butyl, polychloroprene, polyisoprene, silicone and other synthetic elas- tomers			
Production	331,758	314,520	5.5
Imports	39,751	47,762	-16.8
Exports	101,177	80,231	26.1
Apparent consumption	269,056	281,497	-4.4

Business Briefs

Bayer Hispania is expanding its methyl diisocyanate plant in Tarragona, Spain by 50,000 metric tons annually.

Parkway Products, Cincinnati, OH, is expanding its Boone County, KY manufacturing plant by 30,000 sq. ft. The \$1 million project also includes the purchase of specialized machinery and equipment for the manufacture of composite and advanced engineering components for the aerospace industry.

Mobay purchased Conesco Corp., Berlin, CT, a producer of polycarbonate film for industrial purposes.

Iwasaki Electric of Tokyo, Japan acquired Energy Sciences, Woburn, MA, a supplier of electron beam equipment used in converting, crosslinking and other industrial applications.

SP Control has been established in Stow, OH to provide a participative quality control audit program for users of tensometers and ASTM method D2084 curemeters.

Firestone Building Products is relocating its headquarters and technical center to a new 31,250 sq. ft. building in Carmel, IN. The company is also constructing a 83,000 sq. ft. distribution center in Lawrenceville, GA.

International Protective Coatings, Ocean, NJ, has acquired Quelcor, the fire protection division of Thomas & Betts located in Doylestown, PA.

Contracts, licenses

Goodyear and Urethane Technologies International, Irvine, CA have agreed to jointly develop tire and automotive products using polyether urethane materials. Goodyear will initially use the UTI developed technology for the production of pressed-on industrial solid tires for lift trucks. The five-year agreement provides for application of the technology in non-tire products.

Mitsubishi Heavy Industries is supplying Goodyear 32 passenger car hydraulic tire curing presses for its

Lawton, OK plant. Delivery of the ¥1 billion order will begin in February 1989.

Petro Oil and Gas has entered into joint venture agreements with Chinese partners to develop and operate a plant for the production of polyurethane and other polymeric materials in Guangdong Province.

The Laredo Proving Grounds in Laredo, TX have been added to services offered by Standards Testing Laboratories, Massillon, OH. STL has been designated by Uniroyal Goodrich as the marketing agency for the testing site.

Financial statements

Ausimont reported a second quarter net income of \$15.7 million on sales of \$189.7 million.

Cyprus Minerals reported second quarter earnings of \$42.9 million on revenues of \$329.4 million.

Eagle-Picher announced third quarter net income of \$9 million on sales of \$189 million.

GenCorp reported third quarter net income of \$19 million on sales of \$473 million. GenCorp's Automotive sales for the quarter were \$83 million.

The Standard Products Co.'s reported \$508.33 million in sales for fiscal 1988 included \$360 million from its automotive sales. Subsidiaries Oliver Rubber contributed \$72 million in sales and Silent Channel Products of the U.K. added \$32 million for the year.

Markets, news

The International Institute of Synthetic Rubber Producers revised its 1988 forecast for North American synthetic rubber consumption, reflecting the continued strong rebound of SR that began in 1987. In January, the IISRP forecasted a 1.5% decline based on an expected general slowing of the economy and declining automobile production. But based on the increased general consumer demand across all sectors and a rise in exports resulting from the U.S. dollar's continuing competitiveness, prompted the IISRP to revise its forecast to show a 2.8% growth for this year. The institute said all rubber types will show gains, with ethylene-propylene and nitrile rubbers the strongest performers. Their consumption is expected to rise more than 9% over 1987. Styrene-butadiene, which accounts for nearly one-third of all SR use, should gain more than 1%.

H.A. Astlett & Co. predicts greater volatility in the months ahead for pricing of natural rubber. Currently prices remain above the INRO "must sell" range but the buffer stock manager has little rubber to sell. The doubling of demand for concentrated latex, used in the manufacture of examination gloves, temporarily dried up supplies of latex based grades of dry rubbers, resulting in big price jumps. Adjustments by producers have provided the market with adequate supplies, the company said.

IISRP North American rubber consumption
(revised forecast - 000 metric tons)

	1987	1988
Styrene butadiene, dry	815	824
Styrene butadiene, latex	45	45
Carboxylated SBR latex	480	489
Polybutadiene	428	438
Ethylene-propylene	205	224
Nitrile, solid	65	71
Nitrile, latex	7	7
Polychloroprene	84	86
Other synthetics	457	471
Total	2583	2655
Natural Rubber	873	898
Total new rubber	3456	3553
% synthetic	74.4	74.7